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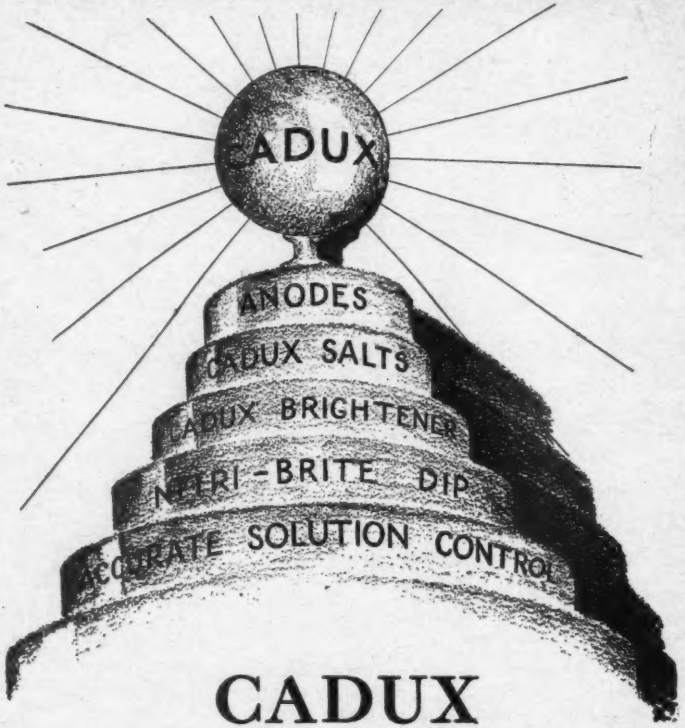

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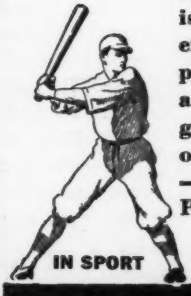

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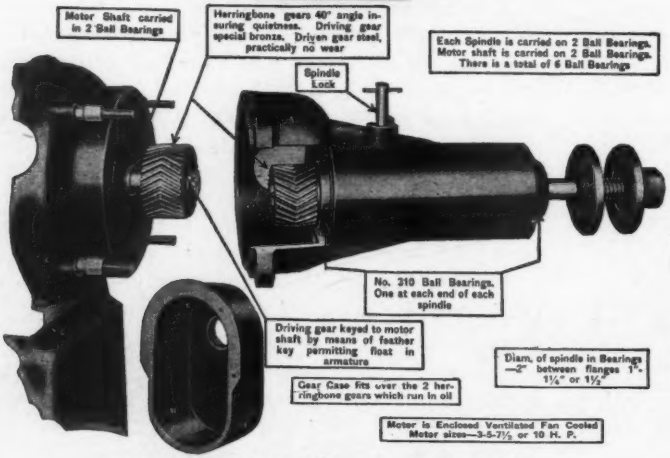
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VOL. XXI OCTOBER, 1934 NO. 3

H. E. Willmore

Born Sept. 29, 1862
Died Sept. 7, 1934

THE plating industry suffered a great loss in the passing away of "Ed" Willmore whose body was laid at rest in Acacia Park Cemetery, Chicago, on September 10th.

Ed, as he was familiarly known to all platers, was born in England, but coming to the United States at an early age, he adopted this country as his own and disliked very much to be considered anything but purely American. While somewhat diminutive in stature he was one of the real "big" men of the plating industry. He was forceful and aggressive in all his undertakings. His many friends will recall his ready wit and commanding personality which bespoke a fine education although but few knew that his schooling ended when he was a boy nine years old.

His real education consisted of almost constant reading and study, and it is a tribute to his determination that he followed his own philosophy — that one should strive to be *the best* in one's chosen work. He was but a few years ago one of the best practical platers in this country, which profession he followed for more than thirty-five years and there are few plating rooms today that do not have his "Formulary" for reference as it was incorporated and copied in plating supply house catalogs.

In his early career as a plater he served successively as plating foreman for the Oliver Typewriter Co., Woodstock, Ill., the Fauber Crank Co., Chicago, the North Chicago Hardware Co., North Chicago and the Grand Rapids Hardware Co., Grand Rapids, Mich.

Ed. Willmore was one of the founders of the American Electro-Platers' Society. Was elected secretary of the Chicago Branch and was the first editor of the MONTHLY REVIEW.

He was one of the organizers of the Crown Rheostat and Supply Co. of Chicago, and was secretary of that company until April 1932, a few months after the death of his much loved col-

league Sam Huenerfauth. Much of the eighteen years with that Company he spent "on the road" building good will with his practical helps that will exist for years to come. Many of his formulae are in use by a great number of platers throughout the United States and Canada.

Quite a few early issues of the MONTHLY REVIEW carried a quotation on the inside front cover that was inserted by its first editor and no finer tribute could be paid him than to repeat it here:

> "I expect to pass through this world but once, any good therefore, that I can do, or any kindness that I can show to any fellowman, let me do it now. Let me not defer or neglect it, for I shall not pass this way again."

They laid his body away but his spirit shall be with us always.

RESEARCH PAPERS AND CONVENTION REPORTS

Your Supreme Secretary, E. Steen Thompson, 905 W. 10th St., Erie, Penna. has a limited number of convention reports and Research Papers for immediate disposal.

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The following Research Papers may be had for the mere cost of postage, while the supply lasts, but must be ordered through your Branch Secretary:

No. 368 — "The Porosity of Electroplated Chromium Coating" by Research Associate.

No. 72 — "The Spotting of Plated Finishes" by Research Associate.

No. 131 — "The Throwing Power of Chromium Plating" by Research Associate.

DIFFUSION ON COPPER PLATED ZINC BASE DIE CASTINGS

By Wilhelm Castell

Delco-Remy Division General Motors Corporation
Member of Anderson Branch

Read at Detroit 1934 Convention

THE use of zinc base die castings has been steadily increasing in the last few years and especially the automotive industry is making a number of parts of zinc base die castings, as for instance, door handles, head lamp supports, horn projectors, etc. As it is a well known fact that zinc corrodes very rapidly when exposed to the atmosphere the parts have to be protected by another metal which is less corrosive and will retain its luster and good appearance. The most commonly used metal is nickel with a thin layer of chromium. The only difficulty in nickel plating on zinc is that zinc is electronegative to nickel and the nickel has the tendency to plate by immersion on the zinc thereby dissolving zinc in the nickel solution. This is especially the case where parts are plated which possess deep recesses and which are difficult to cover all over with a nickel deposit. The black and streaky nickel deposit on zinc base die castings is well known to all platers.

Formerly it was a common practice to plate parts made of zinc base die castings in a cold nickel solution of low metal concentration containing a large quantity of sodium sulphate or sodium citrate. As the amount of nickel deposition from such a solution is very limited the plate on these parts started blistering in a short time in service and the white zinc corrosion appeared on top of the nickel deposit. Most of the specifications of the Automobile Manufacturers are requiring now a minimum plate thickness of .0005″ nickel or a combined plate thickness of .001″ copper and nickel.

At the present time we plate horn projectors made of zinc base die castings of which I have two samples with me. This projector is hollow in the inside and so far, we have not been able to cover this part all over in a nickel solution. In other words, we have been forced to cover this part first in a cyanide copper solution and then nickel plate it.

After polishing and buffing, the parts are degreased, then etched in a solution of 60% sulphuric acid making the work the anode. Then the parts are rinsed and plated in cyanide copper

solution, then rinsed, dipped in a 5% hydrochloric acid solution and rinsed again. The parts are then nickel plated in a nickel solution with high metal concentration, buffed and chrome plated. The amount of copper and nickel deposited must be .001". The nickel deposit must be at least .0005".

The only objection to copper plating zinc base die castings is the fact that a diffusion or alloying process can take place between the copper plate and the base metal. There has been considerable discussion of this matter and a number of automobile manufacturers have raised their minimum thickness requirements of copper plate on zinc base die castings to .0003" and in some cases to .0005" copper in order to compensate for this diffusion. Some platers even have the conception that the copper plate will be absorbed into the zinc and a gap will occur between the nickel deposit and the casting. In other words, the casting will rattle in a shell of nickel.

Due to the fact, that we plate zinc base die castings in a large quantity, we were very much interested in this diffusion and started to invesitgate what is going on between the copper deposit and die cast surface. With the kind cooperation of our metallurgist, Mr. F. W. Carl, who worked out a successful etching process for zinc die cast specimens, we examined a number of copper plated castings with various copper thicknesses.

It was not necessary to prove that a diffusion takes place because anybody who attempts to plate die castings with copper will notice that after plating a die cast part the copper deposit, when separated from the base metal, will show a zinc deposit. This zinc layer might not occur immediately after plating, but will be very noticeable if the copper plate is peeled off a few days after plating. The main question for us was whether the thickness of the copper deposit will have an effect on the rate of diffusion and on the adherence of the plate to the base metal and causing a failure of the protective deposit and how much copper will be lost by diffusion.

I don't intend to go into a lengthy discussion to prove whether the zinc is diffused in the copper or the copper in the zinc or what zinc-copper alloys are formed. Really the main question for the plater is: How much diffusion takes place and how does the diffusion affect the life of the electroplated coating?

First, I will report on our Laboratory experiments. Four samples were plated in the regular production process which

I mentioned before, only the time in the cyanide copper tank was varied.

Sample 1—was plated in cyanide copper solution for 3 minutes at approximately current density of 50 Amps. per sq. foot. The copper deposit was checked at approximately .00007".

Sample 2—was plated for 5 minutes, showing .00014" of copper deposit.

Sample 3—was plated for 10 minutes, showing .00037" of copper deposit.

Sample 4—was plated for 15 minutes, showing .00047" of copper deposit.

All these samples were examined photomicroscopically immediately after plating to check the copper plating thickness. No sign of diffusion could be found between the copper plate and the base metal.

In order to accelerate the diffusion process, parts of these samples were heated at different temperatures and different lengths of time.

(Slide) This sample here, No. 1, shows you a copper deposit of .00007" of copper. Here is the copper deposit, here is the die casting, and this is the nickel deposit, right here.

Now, we took the same sample after it was analyzed and the thickness of the copper deposit was determined and heated that sample, first to 220°F. for a period of four weeks.

(Slide) This is that sample. You will notice that you do not see very much change in the copper layer. In other words, very, very little diffusion can be found at that temperature.

(Slide) Here is the same sample heated at 450°F. for forty-eight hours. You will notice that all the copper has disappeared. In other words, you have an alloy of zinc and copper formed.

(Slide) Now, we took the same sample and heated it longer—for ninety-six hours—and here you see that the structure of the diffusion has been changed. In other words, all the copper has been diffused into a solid layer.

There is one thing that I want to point out here, that even after heating this sample for ninety-six hours at 450° we did not have any separation between the die casting and the copper deposit. In other words, we still showed adhesion.

(Slide) Here is a sample that has about twice as much copper. This picture was taken right after plating, before heating.

(Slide) Here is the same picture after four weeks' heating at

220°F. On this sample you can see very well that diffusion has been taking place. You see a separating line between your die cast and your copper.

(Slide) This shows the same sample, heated at 450° for ninety-six hours. All the copper has been diffused. There is no copper showing any more, and at the same time we have a very poor adhesion to the base metal. In other words, we had to set this sample in solder on both sides.

(Slide) This sample had .00037" of copper. That is taken directly after plating.

(Slide) Here is the same sample after heating at 220° for four weeks. Now, here is one thing that I am not able to explain, because you will find, on this sample, more diffusion at 220° heated for four weeks than you have on the other one. You find, too, that your adhesion is very poor to the base metal. You can see that black line right there.

(Slide) This is the same sample heated to 450° for ninety-six hours. On this sample you see that first diffusion layer has a very distinct brass color. On this sample we have a very poor adhesion, after heating it for ninety-six hours.

(Slide) Here is Sample No. 4, which has the heaviest copper deposit. We tried to get as close as possible to .0005", and we have got .00047".

(Slide) This is the same sample, heated to 220° for four weeks. You can see a distinct diffusion layer.

(Slide) Here is the same sample, heated for ninety-six hours at 450°. We again find that brass color on this sample, and at the same time the adhesion to the base metal is very poor.

Here is a chart showing the approximate amount of copper diffused into the zinc:

	Cu before heating	48 Hrs. 220° F.	4 weeks 220° F.	48 Hrs. 450° F.	96 Hrs.
Sample 1	.00007	Trace. Not Measureable	.00002"	All Diffused	All Diffused
Sample 2	.00014	"	.00004"	"	"
Sample 3	.00037	"	.0001"	.0001"	.00017"
Sample 4	.00047	"	.00005"	.00012"	.0002"

You will see, therefore, how little diffusion is going to take place, for instance, in the period of eighteen months, on a sample in actual service. This specimen here was taken from a horn projector which was just stored in the laboratory for ten months, being subjected to a lot of acid fumes in the laboratory. Part of this projector was microscopically analyzed right after plating, and no difference could be found in the copper deposit. In other words, your diffusion layer is so small that it can not be found.

I do not know whether I mentioned it, but all the pictures were taken at 500 diameters magnification.

(Slide) This projector was mounted on a car for a year and a half. The copper deposit is very heavy at this point, heavier then the nickel deposit. You see right here a very distinct layer of diffusion. When we saw that sample we found that we still had very good adhesion.

(Slide) This piece here is from another projector, also on a car for one and one-half years. We find a little heavier diffusion layer right here.

(Slide) This picture is taken of a projector which was exposed on an outdoor exposure test for approximately twelve to thirteen months. This particular picture was taken of the outside of the bell, as we call it, of this projector. You see, no blisters or failures have appeared.

(Slide) Here you see a specimen from the same projector, taken inside the bell, where most of our failures occur. We were just lucky enough to cut through one of those blisters, and this picture really gives you a pretty good illustration of what happens in corrosion. We had a pit right here. There was some kind of defect in the plate and the corrosion started right down to the zinc base surface and started to blister up the heavy deposit.

You can still see a fairly heavy deposit at this point. In other words, this deposit right here is approximately .0005″ to .0006″ of copper, and this deposit right here is about .0004″ of nickel, approximately.

(Slide) This is another spot on the same projector. You see about the same thing occurring right here. In other words, you find, underneath, a hole, a gap right here, where the plate all the way across the sample is not adhering to the base metal.

(Slide) This sample is taken from the same projector, only taken on the main body, and we noticed before that we had quite a lot of pit holes on the plated surface. This picture gives you a pretty good illustration of what happened on the plate due to the pitting. In other words, the corrosion is starting right down here. We have failures here and there on the plate.

I just want to call your attention to this sample, which had an especially heavy copper deposit, which was buffed and still you will find those failures. Generally on all our outside exposure tests we find that the blistering occurs on places where the thinnest deposit is found—in other words, on this sample right here, where the shape of the part does not allow a uniform deposit the parts are shaded.

(Slide) I just want to show you one picture right here, just to illustrate that some of these blisters are not always due to defective plating, but can be blamed quite often on the die cast manufacturer.

You can see the blister right here—an air pocket right here in the casting, raising up the plate with part of the die casting.

It is hard to recommend a definite process for die casting, but in my opinion, as a result of these pictures and the tests we carried on, it is not required to deposit a very heavy deposit of copper. In other words, a copper deposit which covers the piece all over before it goes into the nickel tank, and which should be approximately .0003″, would be sufficient, providing the nickel is at least .0006″ to .0008″.

At the end of this paper I wish to express my thanks to Mr. W. F. Carl, Mr. D. A. Carson, and Mr. Guy M. Cole for their kind cooperation. (Applause)

CHAIRMAN BLUM: We will be glad to have questions or discussion on this paper.

DELEGATE E. J. WOODMANSEE (Detroit Plating Industries, Detroit Mich.): In your opinion, then, you would recommend a light copper deposit and a very heavy nickel. Is that right?

DELEGATE CASTELL: What I want to point out is that a heavy deposit is not necessary. It would be more economical to run a light deposit — about .0002″, and then a heavy nickel deposit.

DELEGATE WOODMANSEE: You think that that would give the best protection?

DELEGATE CASTELL: That would give at least equal protection to .0005″ copper and .0005″ nickel.

DELEGATE A. GORDON SPENCER (Detroit Branch): In one of your photomicrographs you showed a very heavy coat of copper and then, later on, at 450°, for ninety-six hours, you showed three layers, one of copper, the next of an alloy of copper and zinc, and a third, nearest the zinc, of something else, perhaps a higher alloy of zinc. Then, below that, next to the zinc, was a perforation. Did you attempt to analyze each of those layers?

DELEGATE CASTELL: We did not attempt to analyze each of the layers. It is a pretty hard job to do that. The way we did analyze that was to dissolve the whole deposit and figure the specific gravity of the electro-plated copper deposit, deducting from the total amount of copper found. In other words, we checked the copper deposit that was not diffused and figured the weight, and then we took the whole deposit and dissolved it, then subtracted the two.

DELEGATE SPENCER: It would seem probable, from the appearance, that you had two definite alloys.

DELEGATE CASTELL: We have a variation of alloys.

DELEGATE SPENCER: One of them, nearest the copper, apparently higher in copper, and the one nearer the zinc lower in copper and higher in zinc.

It would appear as if you had an alloy next to the copper, probably an alloy of, say, 70% copper and 30% zinc — I am just approximating — and the one nearer the zinc of probably only 60% copper and 40% zinc, which formed definite chemical compounds with each other and are quite distinct in crystalline structure.

There is one other thing that occured to me in seeing those pictures and that was, why plate copper under nickel at all? Why not start direct and plate brass of a definite or indefinite composition? You would have no diffusion at all and no separation between the zinc base die casting and your brass. You would have a completely bonded plate on your nickel and on your zinc.

DELEGATE CASTELL: In other words, you mean we ought to brass plate the die casting and then nickel plate on top of the brass? I do not know; I have not made any test of that. But I assume that you might get some kind of diffusion from that.

DELEGATE SPENCER: You would not get any separation from the base metal.

CHAIRMAN BLUM: On this point that has just been raised I would like to ask a question. From discussion with other persons, I gather the impression that while you attempted to show the diffusion by distinct colors, actually the diffusion is not so distinct from one to the other.

DELEGATE CASTELL: You could see that at different temperatures and at different times the structure of the diffusion would change. It gradually comes to a saturation point, and we think that, the less copper, the sooner you would reach that saturation point. We have not made enough tests to prove that.

CHAIRMAN BLUM: I would like, if I may, to ask another question, and that is as to whether you have any explanation for the separation. Did you suggest that the copper-zinc alloy occupies less space than the copper and zinc separately, or is it because it has a tendency to contract, or is it more brittle? Why should there by any separation because they alloyed?

DELEGATE CASTELL: One theory is that we think it is a very brittle alloy. It is a low copper and high zinc alloy, which is very brittle. Another thing (maybe I forgot to point it out) is that all your separation never takes place — at least we never found it to take place — directly underneath the copper. It always takes place at the lowest point of your diffusion. It is pretty hard to prove what the real cause of that is.

MR. E. A. ANDERSON (New Jersey Zinc Co., Palmerton, Pa.): Unfortunately I did not get in on the early part of the discussion, but I might add a few points in connection with the copper diffusion with zinc. There is no question but what the diffusion is copper into zinc, rather than zinc into copper, and X-ray specimens have shown that in that diffusion you get every phase in the copper-zinc equilibrium system with the exception of the solid solution of zinc in copper that is represented in the 70-30 type brass.

It will not make any difference whether you plate copper or brass, you will get all of these diffusions, and certain of them, in the range anywhere from ten per cent of copper up to sixty per cent of copper, will be brittle and white, and in that range you are bound to have them. You cannot get away from them, and any stress that is exerted on the casting or on the coating will crack these diffusion layers. You are almost bound to have that stress, since the thermal expansion of the zinc is something like three times that of the coating, and the moment they get heated

up and cooled down something has to go, and it is usually in this diffusion.

CHAIRMAN BLUM: I would like you to amplify that point as to what is the difference between the copper going into the zinc or the zinc going into the copper. I used the illustration that if you mix some alcohol and water they are mixed together, and you cannot tell whether the alcohol has gone into the water or the water into the alcohol.

MR. ANDERSON: It is of no practical importance in the present case. It is simply a matter of metallurgists trying to decide which way that thing happens. You will find, down at the bottom of the whole collection of diffusion layers, a solution of copper in zinc, but you will not find a solution of zinc in copper. It is simply a matter of direction, but you get all the layers no matter which way it happens.

CHAIRMAN BLUM: Is there further discussion of this paper?

DELEGATE G. M. COLE (Anderson Branch): There is one point that I would like to bring out. On the sample that Mr. Castell has here, this was exposed in Detroit for a little over a year. That casting is showing failures; it is showing blisters. Another one like it, exposed at the same time, is showing a little diffusion.

Now, the diffusion is uniform all over that casting, but the blisters are occurring only where the plate is thinnest, with one exception — on the side. We consider that to be a very good example. This casting, in going through the copper-nickel tank, was in this position (illustrating), and we were well aware of the troubles we had had in plating these. This upper surface here frequently wanted to show some brittleness. We can tell which side was up by the rack mark right here.

In buffing, naturally roughness would be torn out by the buff wheel. That particular surface is showing blisters, and the opposite surface is not.

We also took a casting like this and checked the uniformity of the deposit, and found that when we had well over .001" of total plate in this area and around here we frequently could get only .0005" in here, and a diminishing amount back inside the bell, which is quite an important area, because it sets on the car in this position.

We took one of these horns that had been exposed and checked wherever the blistered area occurred and found these varying

thicknesses. In nearly every case where the blisters were very heavy the plate was .0005" or under, but where we went from .0005" to .001", except where the roughness occurred (and presumably the pits), wherever the total plate thickness was sufficient, the zinc base metal was protected in spite of the fact that you had diffusion there or not.

Now, if the expansion of the zinc upon heating and cooling during the day is presumably going to cause blisters, it should cause them anywhere, regardless of the thickness of the plate. It is true that if you take a casting when it is first plated and try to knife the plate off you cannot move it. You can gouge it out, but you cannot peel the plate off. But, if you come back in a month, you will find that you can lift the plate. The time may vary. From this casting, after a year, I dare say you could knife the plate.

No matter how you prepare the casting before plating you can get a good bond between the copper and the zinc to begin with, but that bond does not stay good. The rate of diffusion is so slow, however, that within the useful life of this piece you need not expect the copper deposit to disappear.

CHAIRMAN BLUM: Are there any further questions? If not, we wish to thank you, Mr. Castell, for your presentation. (Applause).

In looking over this program as a whole, and especially the program for this evening, I am struck by the fact that we have papers on almost everything except plating. That simply means that plating, as an industry, has so many phases that we can no longer consider that we have solved the problem if we simply find the composition of a plating solution, the temperature, and the current density, and that we realize more and more that in order to do good plating we must know more about other things than the actual solution, temperature, current density, and so on.

The Membership Drive has been taken up with a lively interest by a number of Branches.

RUBBER IN THE PLATING INDUSTRY

By R. H. Kittner, American Hard Rubber Co., Akron, Ohio

Read at Detroit 1934 Convention

METAL parts are electroplated in order to enhance their beauty and to protect them against atmospheric corrosion. Many of the solutions from which these metallic coatings are deposited are themselves highly corrosive to metals and most other materials of construction. A problem therefore arises in finding a material suitable for use in the construction of tanks and equipment to handle these solutions.

Metallic corrosion has become a problem of greater and greater importance to the processing industries through the increased use of acids, alkalies and salts. The question arises frequently, "Of what material should we construct our processing and handling equipment so that we may expect it to last, not to contaminate our product, and be reasonable in initial, final and maintenance cost?" This question has resulted in the development of many organic thermoplastic materials to solve the problem. Rubber is the oldest and most widely used of these materials. It is with rubber—its development and application to the plating industry—that we are herein concerned.

Pure gum unvulcanized rubber was used many years ago in tanks for storing hydrochloric acid, but it could not be used for pumping equipment to transport the acid because it has no structural strength. Hard rubber was found to have much of this required structural strength, and could be molded, fabricated and machined into required shapes, if the size of the equipment were not too large. About fifteen years ago the science of bonding rubber to metal began a rapid development. With the possibility of bonding rubber to metal, the size of the equipment that could be manufactured became almost unlimited, so that today practically any piece of chemical processing and handling machinery can be designed and built, combining the corrosion-resistant qualities of rubber compounds and the structural strength of steel.

Vulcanization of rubber involves primarily the addition of sulphur and the application of heat at controlled temperature, over specific periods of time, to bring about the polymerization of the rubber molecule and the addition of sulphur to the molecule. The rubber molecule contains many double bonds, being

an unsaturated organic polymer. The opening up of these bonds, with the addition of sulphur through them, changes the character of the rubber from a thermally unstable organic material to a stable one. The amount of sulphur that can be added and entirely combined with the rubber molecule varies from a fraction of a per cent to approximately 47 per cent and, correspondingly, the characteristics of the finished product vary from soft, tough and elastic to hard and brittle. Hard rubber, because it contains more combined sulphur, is more stable than soft and is, therefore, generally speaking, more resistant to the actions of acids and alkalies.

Sulphur is most commonly added to the various blends of crude rubber by milling. During this milling and mixing operation there is opportunity for the addition of many other ingredients which will alter advantageously the physical and chemical porperties of the finished product. We may rightfully say that through the addition of these materials we can form a great variety of rubber alloys which can be developed so that they will have predetermined properties which will excel in certain physical, chemical or electrical characteristics best suiting the requirements of the equipment in which they are to be used. It is a false impression that rubbers having certain color characteristics are superior chemically or physically. Color is due only to the types of crude rubbers and pigments used and is in no way indicative of the ability of the compound to resist chemical deterioration.

Ordinary chemically-resistant hard rubber without metallic reinforcement cannot be used at temperatures above 120°F. But by the addition of inorganic oxides and silicates we can increase this temperature limitation to approximately 150°F. This limitation is due only to the fact that the hard rubber softens sufficiently above 120°F. to make its use impractical. Inasmuch as rubber has great covering power, the addition of these inorganic materials (although they in themselves are not chemically inert) does not decrease the chemical resistance of the final product. These addition agents act only as stiffeners and form a group of alloys known as heat-resisting compounds. The addition fillers for this purpose are not adulterants but serve a special purpose; moreover, they cost more today than the raw rubber itself.

A good example of the use of a heat-resisting compound is the plating barrel. Here we must have a compound which will be chemically inert, an excellent insulator, have good wearing qualities and sufficient structural strength at temperatures as high as 160°F. Most rubber compounds have good chemical and electrical qualities, but combining these with abrasion and heat-resistance was difficult. We can safely state that it has been done, so that today a barrel can be manufactured from hard rubber which will be electrically sound, structurally good, and not subject to chemical deterioration.

In certain processing industries the use of rubber has progressed with difficulty because the solutions being handled contain, besides acids, hydrocarbons which have a solvent action on the rubber. Compounds which have been developed in the past few years have corrected this. They contain, in general, asbestos and other inert fibrous material, inorganic stiffeners, and most recently, synthetic substitutes, such as duprene and thykol in varying percentages. These synthetic substitutes have remarkable solvent resistance, and are most often used by blending with rubber. Chlorine gas affects most organic material, yet hard rubber compounds have been recently developed for lining pipe and valves used in the electro-chemical manufacture of chlorine, and handle wet chlorine gas at 180°F. In special instances rubber lined equipment is in use at temperatures in excess of 212°F.

We cite these particular cases of special compounding to emphasize the point that a proper compound usually can be developed to suit each particular condition experienced in the industry. Although the rubber-chemist in most cases can predict from experience the results to be obtained by the addition of various materials, the compounding of rubber remains an art and the results of special compounding can only be determined accurately by actual trial. From this we gather that it is impractical for the chemical engineer to specify a particular composition for his purpose. It is best to leave this specification to the rubber manufacturer, furnishing him with complete details concerning chemicals in contact with the rubber and the physical conditions under which the equipment will be operated.

Perhaps the most significant development in rubber equipment technology is the bonding of rubber to steel, for almost all electro-chemical processes today are on a large scale at

temperatures in excess of 100°F. The use of steel as a structural base for the rubber involves the lining with rubber of pipe lines, tanks, valves, pumps and specialities.

When coating metal with rubber compounds, care must be exercised in the design of the metallic parts. It is of prime importance to avoid air pockets beneath the rubber for, during vulcanization, this entrapped air expands with the increase of temperature and causes the surface of the coating to blister. The entrapment of air usually occurs beneath poorly welded and improperly designed seams where the metal sheets or parts are placed together. Often porous sheets and castings have the same effect. Riveted tanks and equipment can be rubber-lined, but their use is not good practice in view of possible air entrapment. Equipment to be lined is usually prepared and cleaned by sand blasting. Next, the article to be lined and the unvulcanized rubber compound, in the form of sheets or tubes, are both coated with cement. The rubber is applied to the steel by hand, in a manner similar to hanging wall paper, using an overlapping seam and pressing the rubber against the walls with hand rollers. The workman, in applying the unvulcanized sheet to the article, uses great care in the construction of the seams and in rolling out entrapped air. The unvulcanized rubber is soft and plastic, and it is advisable, therefore, to round all edges and corners in order to avoid undue stretching of the uncured rubber.

As the application of rubber to the metal is a hand operation, the original design must be so planned that the workman has easy access to all parts which are to be coated. In order to be able to get at the inside of closed vessels, and to be able to ship and handle very large pieces, "rubber liners" use a flanged type of construction. The tanks, pumps or fans which are to be coated are made up in sections, joined together by flanges and bolted. The coating is brought out over the surface of the flanges with soft rubber gaskets vulcanized to the faces; thus, when the sections are assembled, we have a continuous sheathing of rubber on all surfaces which are to be protected. The size limitation of the equipment, using sectional design, stops only at a point which marks the limit of our ability to increase the size of the metal base. A tank 80′ long x 30′ wide x 14′ deep, constructed in seventeen sections, is now in use at the Clayton Mark's Plant, in Chicago, Illinois. It is part of an automatic machine plating conduit tubes. Flanged construction also allows

for easy inspection of closed types of equipment. All rubber lined steel pipe and fittings are of the standard flanged type.

Whenever possible, rubber coatings are vulcanized under pressure in order to eliminate porosity and the formation of gas bubbles in the rubber layer due to moisture occlusion. Vulcanization of the rubber linings is therefore carried on under thirty to sixty pounds steam pressure in large closed cylindrical autoclaves, called vulcanizers. With the heretofore described sectional design of equipment, the vulcanizer size does not limit the size of the articles that can be cured under pressure. Lining compounds, containing very active accelerators which effect vulcanization at low temperature, can be cured in open vessels filled with brine or water heated with live steam. Linings in large closed vessels are often vulcanized by using the vessel itself as the vulcanizer, introducing steam under pressure into the vessel through suitable inlets.

The type of cement used to bond the rubber to the metal most naturally is a large factor in the service to be obtained from the lined equipment. Some manufacturers today use thermoplastic cements which show extremely high adhesion at normal temperatures but lose this bond, at temperatures in excess of 155°F.

Research has recently produced cements which are only slightly thermoplastic and which retain most of their adhesive qualities even at temperatures up to 212°F. Care must, therefore, be exercised by the manufacturer in the selection of cements to be used with high temperature and vacuum equipment. When lining with hard rubber, a cushion of soft rubber is applied between the metal and hard rubber in order to absorb shock and to allow for difference in contraction and expansion between the hard rubber and metallic base.

The coefficient of thermal conductivity of rubber cannot be accurately set down in physical tables as it varies greatly with the compound used. It is sufficient to state that rubber is best classified as a heat insulator. A standard thickness (3/16″) of combination hard and soft rubber lining applied to steel (1/8″ thick) has a thermal conductivity of approximately 7.4 BTU/hr/sq. ft. of surface 1°F. Jacketed equipment and heating coils have been coated with rubber and successfully operated, but in view of the low heat transfer rate of the linings, this is only expedient when no other material can be practically used.

Where possible, steam coils or live steam should be used to heat solutions in rubber-lined vessels.

In such operations as pickling, mechanical abuse by parts being handled in the vats is so severe that it causes excessive damage to the lining. This difficulty has been circumvented by the use of properly constructed interliners of wood or ceramics. Common practice makes use of acid-proof brick and cement linings with soft rubber expansion joints, or slab-stone linings with soft rubber pads and joints so laid out that no cement is necessary, the slabs being keyed in place and easily removable. Pickling vats have long been a source of trouble to the metal industry, and every means has been tried to obtain tanks that would hold the pickling solution without continual maintenance. The construction just described is proving itself equal to the requirements, and, even in the face of greatly reduced operations, many large installations have been made in the past two years.

In addition to resisting the corrosive action of all plating solutions, with the exception of chromic acid, hard rubber is an excellent insulator. It is, therefore, a specific for lining electroplating tanks, covering plating racks and in the manufacture of plating barrels. It has eliminated current loss and short circuits found when using wood or lead lined tanks. Using rubber lined tanks and eliminating electrical leakage and grounded equipment due to acid soaked wooden tubs, the plating cycle can be cut as much as 25% and the amount of work turned out per day with the same electrical equipment increased in proportion. The rubber-covered plating rack carries the current directly to the work to be plated and makes possible large savings in current, metal, and solution as well as improving the quality of the deposit through better distribution of current.

Rubber can be deposited electrolytically from a colloidal suspension of latex in water. The colloidal particles of latex are negatively charged, and therefore are deposited at the positive pole or anode. The process is, therefore, called the anode process. Sulphur, carbon black, and other materials essential in the compounding and processing of rubber can also be dispersed in a water solution to form a negatively charged colloid, which can be mixed with a latex solution and deposited at the same time as the rubber to form a rubber alloy or mixture. Rubber covered plating racks manufactured by this method are far superior to those formerly covered by hand, since they eliminate

all seams which are difficult to maintain tight on the small, irregular surfaces and cross-sections of a plating rack. Due to the many unusual shapes and angles that a plating rack contains, the anode process allows for the rubber covering of racks at a figure often far below the former cost of hand covering.

Soft rubber is best suited for lining outdoor acid storage tanks and for lining tumbling barrels. Due to the peculiar quality of soft rubber to resist abrasion, it can be estimated that the life of a tumbling barrel lined with soft rubber will be increased nine to ten times that of a barrel lined with other materials. An every-day example proving the worth of soft rubber to resist mechanical wear is the automobile tire. Compare the distance one might run on steel rims before tearing them to pieces with the life of the present day tire. Besides increasing the life of the barrel, the soft rubber, due to its elasticity, speeds up the tumbling cycle and in cases of acid tumbling is also proof against chemical deterioration.

The fact that rubber-lined steel tanks prevent metallic contamination of the plating solutions and eliminate all chances of anodes and work short circuiting, either by actual contact with the tank or through stray currents, cannot be over-emphasized. In large automatic or continuous systems for cleaning and plating parts, it is absolutely necessary to prevent contamination, as a large volume of expensive solution would be spoiled. One short circuit might cause the shut down of the entire system, and is often most difficult to find.

Rubber coatings are absolute protection against such conditions. Most wooden tanks prove a source of trouble due to continual leakage of valuable solution, whereas rubber-lined tanks are solution tight, being of welded steel construction with a continuous coating or impermeable material on the inside. In filtering, circulating or agitation of plating solutions, rubber equipment plays just as important a part as in the tanks. Most any sort of piping and valves can be furnished in rubber-lined steel or all hard rubber threaded or flanged. Several very large tanks over 40′ long have been in service now over eight years and are still in perfect condition. We might cite tanks installed at the Buick Plant, Flint, Michigan, in 1926, and Franklin Motor Car Company, 1929, both of which are still in service to the best of our knowledge.

In buying any type of capital goods equipment, the cautious

purchaser does not merely look at the initial price. A certain manufacturer of razors was able to show, through the use of properly designed rubber covered racks, a saving of many thousand dollars per month due to gold which was formerly plated out on his racks and which was difficult to recover.

Careful analysis of losses, due to current leakage through short circuit and stray currents, and due to loss of metal from solution plated out on unprotected conductors will easily justify the purchase of new equipment involving rubber protection. These analyses may also prove that such equipment will quickly pay for itself in a very short period of time. (Applause)

CHAIRMAN PHILLIPS: Are there any questions, gentlemen?

MR. MEYER: I would like to ask the speaker one question on his very interesting paper. Some years ago some extensive work was done at the Bureau of Standards on the deproteinization of rubber. In the deproteinization of rubber the water resistance of the rubber was markedly increased. Do you know whether that invention or discovery has been applied to the use of rubber-coated articles in the plating industry?

MR. KITTNER: The question was asked me last night by somebody as to whether tanks were satisfactory for use with pure hot water, in which no electrolyte was present. Soft rubberlined tanks are not suitable using hot water, as there is diffusion of water through the rubber, but hard rubber does not show any diffusion of water and therefore the question can be best answered by saying that we use hard rubber-lined tanks where water is present, and no attempt that I know of has been made to stop diffusion in the case of soft rubber.

DELEGATE SLATTERY: While I understand that you folk recommend the inclusion of a sandstone slab there we have operated the rubber-lined tanks for four years and have not found it necessary to use the slab, but occasionally there might be a small perforation due to accident. Have you any method of repairing a small spot like that?

MR. KITTNER: All rubber tanks may be repaired if the perforations are not too large, and by "too large" I mean several square feet. You can patch them the same as you patch an inner tube, using a special method which the customer can be instructed in, so long as we can get a heater large enough to cover the area or are able to boil water in the tank in order to

bring about the cure of the patch. We can patch any such abuse in the field very satisfactorily. That sandstone lining is used only in the case of pickling in the steel industry. I do not believe it enters into your industry very often. There you have very heavy parts and material that would be very abusive to any sort of lining, whether it be lead, rubber, or anything else. In the case of parts being plated, they are usually not so heavy that, if they do drop, they would injure the lining.

SEA WATER AT $4.45 A GALLON

A FEW weeks ago the good people of Monhegan Island, which rises from the sea 20 miles offshore from Boothbay Harbor, Maine, thought that Professor Oliver P. Watts,* of the University of Wisconsin, had gone crazy. They learned from Earl Field, one of the residents of the island, that the professor had written him and asked him to send him, by express, a gallon of sea water. For this he was willing to pay $3, or more, plus the carrying charges, which turned out to be $1.45.

The professor's letter specified that the water must be strictly "fresh" and dipped up a good distance from the shore. So Mr. Field, being a conscientious fellow, got in his dory and rowed a mile or more out into the open sea before he filled the can, which he carefully crated and sent on its way to the Middle West.

Prof. Watts, who knows his Maine coast, was conducting a series of experiments to find out how to prevent the corrosion of certain metals. He wanted to know what salt water did to these metals before and after they were treated and it seemed to him that his tests would not be conclusive unless he used the real thing.

"I could have made up an artificial sea water by adding the right amount of salt to fresh water," the scientist explained, "but I knew that some critic might say that my findings were doubtful, or no good, because I hadn't used the real stuff. That's why I was glad to pay what seemed an exhorbitant price for a can of plain ocean."

Until the experimenter made this explanation his friends on Monhegan Island suspected that he had gone a bit "daffy" from overwork, but news of the professor's experiments allayed any such fear and caused the Monheganites to wonder if they could not, on the strength of this sale, supply other scientists with the salty liquid that beats up against the rocks in their dooryards.

*Professor Watts is a member of the Chicago Branch, A. E. S.

CONCENTRATED CYANIDE COPPER PLATING BATHS

L. C. Pan*

IN an article published by the writer in *Metal Cleaning and Finishing*, March and April, 1933, entitled "Concentration of Cyanide Copper Plating Solutions," a striking relationship was discovered between the concentration of copper cyanide and the operating qualities of the cyanide copper plating bath, such as the current efficiency, bath voltage, solution resistivity, anode and cathode polarization, and character of deposit.

It was found that a solution containing one mol of copper cyanide (63.57 grams of copper per liter or 8.5 ounces of copper metal per gallon) showed the most desirable qualities. For instance, that particular bath as described in the above referred article showed an anode efficiency of 98 per cent. and cathode efficiency of 81 per cent. The free cyanide content of that particular bath was 1.9 oz./gal. (14.7 g./L.) and the sodium carbonate, Na_2CO_3, content 41 g./L. or 5.5 oz./gal. The concentration of these latter two ingredients were arbitrarily chosen from data available on cyanide copper plating solutions of much lower concentration (See *Metal Cleaning and Finishing*, November and December, 1931, pages 585, 651 and 658; and January and February, 1932, pages 19 and 81). This paper is intended to give further data relating to these two ingredients while the copper content of the bath is held constant at one mol (equivalent to cyanide copper content of 12 oz./gal.).

Starting with a solution containing 12 oz. of copper cyanide dissolved in a sufficient amount of sodium cyanide in water, and varying the excess or free sodium cyanide content of the bath, a series of current efficiency determinations were made in a Haring cell measuring 15 cm. between anode and cathode, and an immersed area of 5 x 5 cm. each. The temperature was between 22 to 24 degrees C. and the current density was 2 amperes per sq. dm. or 18.5 amperes per sq. ft., throughout the series of determinations.

While the current efficiency determinations were made, which lasted 30 minutes of actual plating time each, a set of readings were made at the end of 25 minutes for the bath voltage, temperature, resistivity, anode and cathode polarization, with the aid of two screens of perforated copper sheet spaced so as to

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divide the distance between anode and cathode into three equal parts. The perforations in those screens amounted to not less than 60 per cent. of the plane surface.

Taking up the variations of cathode efficiency first with respect to free cyanide content of a bath containing one mol copper, the relationship is essentially in a straight line, namely cathode efficiency of such a bath with carbonate content of approximately 43 grams of Na_2CO_3 per litre, decreases directly with increase of free cyanide from 95 per cent. at no free cyanide to 27 per cent. at 40 grams of free sodium cyanide per litre.

This decrease in cathode efficiency with increase of free cyanide is in agreement with previous findings in cyanide copper plating baths of lower concentration. On the other hand, the anode efficiency of the same bath increases with free cyanide content, which fact is also in agreement with previous findings with the exception that the anode efficiency is not depressed by the presence of carbonate in the concentrated bath.

For numerical values of current efficiencies in the concentrated cyanide copper plating bath, see Table I.

Table I. Current Efficiencies of Concentrated Cyanide Copper Plating Bath Containing Copper 63.57 g./L., Sodium Carbonate 43 g./L. at Room Temperature and 2 amp./sq.dm.

Free Sodium Cyanide, g./L. by Analysis	Anode Efficiency	Cathode Efficiency
0.15	43.4	94.2
4.0	66.5	89.9
4.35	67.4	86.3
4.55	68.2	.....
6.9	67.0	71.7
8.05	78.0	86.2
13.45	88.5	80.0
20.05	80.5	58.7
20.95	93.0	62.9
23.2	89.5	57.3
25.05	87.5	53.4
32.6	97.1	41.5
40.0	90.0	26.7
42.25	95.8	19.8

The resistivity of the electrolyte increases with increase of free cyanide content, which was to be expected. The increase

however, was not very great because the electrolyte has high conductivity to begin with. The variation was only one ohm per cm. cube, from zero free cyanide (8 ohms per cm. cube) to 42 grams of free sodium cyanide per litre (7 ohms per cm. cube).

Varying the free cyanide content in the concentrated copper bath produced practically no effect upon cathode polarization. In the case of anode polarization, however, there was a minimum at a free cyanide content of about 12 g./L. (1.5 oz./gal.). Much higher anode polarization was observed when the free cyanide was lower. All that refers to an electrolyte containing sodium carbonate 43 g./L. For carbonate content other than 43 g./L., another series of tests were made.

The electrolyte for this second series of tests contained copper cyanide 12 oz./gal., free sodium cyanide 1.1 oz./gal. and sodium carbonate varying from 2 to 21.5 oz./gal. in terms of Na_2CO_3. It was found that anode polarization decreases rapidly with increase of carbonate content until a point is reached at about 5.5 oz./gal. Na_2CO_3, then it becomes practically constant with further increase in carbonate content.

Anode polarization increases with current density. The increase is a rapid one. But the increase is not as much when carbonate is 10 oz./gal. or over, as when it is around 5 oz./gal.

From the foregoing results, it is possible to select a set of conditions for the concentrated cyanide copper electrolyte, so as to produce the most desirable operating characteristics. For instance, we could aim at a high current efficiency and therefore choose a relatively low free cyanide content, such as 1 oz./gal. We could also choose a low anode polarization and therefore use a high carbonate concentration, such as 10 oz. of Na_2CO_3 per gallon. Such a bath was prepared and tested again in the Haring cell, and the following data were obtained:

Bath Composition	
Copper cyanide	12 oz./gal.
Free cyanide by analysis	1.1 "
Sodium carbonate	10.4 "
Temperature	22 - 23 degrees C.
Current density	18.5 amp/sq.ft.
Anode current efficiency	75.5 per cent.
Cathode current efficiency	95.0 " "
Voltage across Haring cell	4.6 volts.
Cathode deposit	Smooth, matte.

Anode appearance	Blue coloration, immediately soluble in electrolyte.
Anode polarization	1.55 volts.
Cathode polarization	0.85 "
Resistivity of electrolyte	7 ohms/cm. cube.
Throwing power (Blum-Haring method, distance ratio 5, total current 1 amp. for a total cathode area of 0.5 sq. dm.)	47.4 per cent.

From these results, it appears that there is a decided advantage of this concentrated cyanide copper bath in comparison with acid copper bath for practical applications of copper plating. For instance, since the acid copper bath has a cathode efficiency of 97 to 98 per cent. and an electrochemical equivalent for copper of 1.186 grams per ampere-hour, and the concentrated cyanide copper bath has a cathode efficiency of 95 per cent., but the electrochemical equivalent for copper there is almost double that of the acid copper bath.

As a matter of fact, the general practice for acid copper plating is to plate at not over 18.5 amperes per square foot. If the latter current density is used with the concentrated cyanide copper bath, we could do copper plating almost twice as fast in the cyanide bath.

In addition, we shall have a much higher throwing power from the cyanide copper bath. Established data show that the standard type of acid copper plating bath (containing no brightener or additional agent) has a throwing power of 9 to 10 per cent. when tested under similar conditions.[1] A higher throwing power will enable the bath to plate more uniformly and therefore makes the bath more economical to operate.

Furthermore, the cyanide copper plating bath has the advantage of being directly applicable to steel and iron, making it possible to copper-plate the latter metals with a single operation, thus saving labor and time.

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[1] Blum and Haring, Transactions of American Electrochemical Society, Vol. 43, (1923) pages 333-337.

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FINISHING BRONZE AND BRASS STATUES

By E. N. Bintner

Read at New York Branch Meeting

THERE has been an effort made within the past year to clean the municipally owned bronzes of New York. Credit is due to the few, who conscious stricken enough to realize the neglect and the low level of respect these mementos of our great have fallen and were prominent enough to marshal the aid of the unemployed.

With this help, willing enough probably but unskilled and untutored in this work of arts, with never a knowledge of Patina on Bronze, far less of the value, reproduction maintenance or the enhancement of Patina, to these, this work was intrusted, with the motto of the supervisor on the job:

"We clean both, the Marble and the Bronze"

As there was more masonry than Bronze, to a practical man, a bricklayer out of work was given supervision. I asked this worthy the treatment he was giving the Bronze Patina and he was very vague in his reply until I called his attention to the green powder deposit on the Bronze. "Oh that, you mean the rust" he answered, "Well we scrape off as much as possible and let it go at that." I wonder if the Museum of Arts would care to employ artisans of this nature.

This is the result of unthinking and unreasoning, misguided by the desire to do something cheap without going into details. The enclosed letter to the Commissioner of Parks has not been answered until this day. Materialism replaced thought and art—"Pearls to the Swine".

This article is dedicated to the memory of those worthy of their Bronze Memorials.

REASONS FOR MEMORIALS

In the clan halls of Borneo and the South Sea Islands the effigies of their great men, whether friends or foes, are prominently placed and honored and cared for. We may travel from there to the frozen North, again we find mementos of them they feared, honored, revered.

THE TOTEM POLES OF THE INDIANS

It was desired in either place, whether North or South to give honor in the only way they were capable of, by their limited means, to express in lasting wood carvings their thoughts and by their weird decorations.

When the intellect of man had risen with the desire for better and more lasting mementos, he found possible the working of stone and since then no labor has been spared in creating cenotaphs, and we find in the temples of Bali, in the Shrines of old India, in the marble halls of Athens and of Rome, the petrified thought expressed.

But the "Taj-Mahal" Memorial built by Shah Jehan for the remains of his wife and in her memory, to speak thereof, words fail in description, it's but a dream come to realization. It was reserved for the generations following the Stone Age the discovery and artistry in metals in all their beauty, whether in the raw or covered with the cloak of nature, the Patinas.

Each of these materials, wood, stone, marble and finally metals in their pure state or in alloys, has been used in mental and artistic and intellectual expression to give honor to those, who, by their actions were loved, honored, revered, respected and feared.

Therefore, we, as an advanced progressive nation placed upon the pedestals of marble and stone the mementos of those whose hallowed memories have enshrined themselves in our hearts and minds.

IN THE CLAN HALLS THEY CARE FOR THEIR MEMENTOS

We, a thankful community erected these Bronzes by public subscriptions or by private donations. These memorials are testimonials of the acts and deeds of charity, of grandeur, of heroic sacrifices, of those who gave their all, even up to the supreme sacrifice that others may live and prosper.

We placed these memorials that our children may be reminded from generation to generation of these we called our fathers, our heroes. We gave with full hearts and in thanksgiving, with the sole desire to repay, by the only way possible, to keep forever fresh in our memory, by prayer and memorials, where all other recourse was closed.

But we might have placed a rock in place of the Bronze for all the interest shown in them, after its placement has outlived scarce a generation.

A sick, crippled old tree may get attention and is cared for but for the many Bronzes in New York City the expenditure has been as low as $800 a year. The City of New York, as well as other cities, have not alone failed in the trust given them as

custodians of the most precious and priceless treasures, but they have, by their neglect, disgraced the memory and the dignity of their enshrined.

Why, we ask, are they, these bronze Memorials of so little appeal to the eye, if for nothing else?

COLOR AND ITS VALUE

We know form to exist without color but it will never satisfy the instinct of the human mind and no system of national decoration even the most primitive has even existed in the absence of color.

Mere form, mere light and shade may please to a certain extent, but it falls far short of what we require and it is only when we get perfectly proportioned forms in combinations, harmoniously arranged, that we are satisfied. Thus in the Halls of the Mighty, in Cathedrals and Shrines as well as Amphitheaters, color combinations gave expressions and always brought back its assemblies for renewed admiration and revered peace, where the spoken or written word would not have been understood. Therefore, yes, even to-day, the color harmony in our temples of worship will fill some to overflowing and leave others with empty pews.

Gray with the dust of the gutter, streaked with the offal of the birds, why has not one tried to break the monotony of tone of our memorials? Are they worth less than the grass that surrounds them? The green is restful to the eye, we love to see it and never tire thereof, in fact, everything of nature looks beautiful in its place. The condition of the Bronze Patinas are not the natural decomposition, but are the surface products of the surroundings, and counter-actions of experts are needed to overcome these conditions.

Who are the experts in metals color arts? Who are they that even today cherish and practice the arts of chemical coloring? It is they, who have neither squandered but rather improved, the heritage of our forefathers.

It is said, Cyrus, the Persian, great conqueror when conquered by the desert sands, threatened vengeance, and by actual calculations reached the subterrain reservoirs of water, built immense cisterns to protect them and crowned them with an angel, at distances of a day's camel drive. To be able to see them for long distances he ordered these angels to be covered

with green Patina, a green beacon, in an endless sea of brown. A solution of acetate of copper, water, salt, fruit juice and salamoniac was used, applied before sunrise and alternated daily with a bath of water, for two weeks, until a strong, hard green had been formed, then the whole figure was covered with wax. (A) The shifting dunes have reclaimed and covered, what for a time gave life and served the living with the source of life, water.

What tales may be told about the history of Bronze, but can we say that if the art of castings reached the pinnacle of perfection, the care of the same and the possibilities of color developments was left solely to chance and the actions of Mother Nature without the aid of men and artisans, solely interested in these color developments, we may as well deny the alchemists of the past millenniums for, throughout the time when metal was discovered, its blendings in color, was a constant source of urge for research for the transmutation of metals and among the great of the past Hermes, the Egyptian has been referred to, as the possible author of the Ebers Paprus pertaining to metals and alloys, colors, etc.

Therefore, we must admit the existence from the earliest times of artisans in bronze and metal colorization, developed first with the crude materials available. Among the first and largest employed are the copper salts, able to produce alone or in combination with other chemicals the widest range of colors any chemical metal salts are able to produce. Thus a very weak solution of sulphate of copper will develop a range of from light gold to orange, when reduced to carbonate of copper with but a trace of acidity, its range is even more pronounced on copper, bronze or brass. I have in my time produced a gilt color on bronze, as near to the real thing as possible. Acetate of copper owing to its acidic contents has a different scale of coloring, from brown to green according to its density and heat units, applied with additions of chloride of sodium, and chloride ammonium developments of green. Addition of chloride of copper, will by a susceptibility of sun rays give black and gray. Nitrate of copper, in combination with nitrate of silver, brushed on brass and bronze and heated, will give a very fine instrument black, thus we see by the mere manipulation of copper salts as a basis, we have one of the greatest factors of foundations of metal color art. To say, that to-day

only a scientist should be the controlling individual to order this or that color by his scientific training ability is to tell a painter to use the three primary colors, blue, red and yellow spectrum colors and paint Mona Lisa.

Each man to his place and let him fill that first before forcing himself to the front on the stolen ideas of his fellow man with deceptive conclusions. The bronzeur of the day as well as the plater is forever called upon to cover the imperfections on metals left voluntarily or intentionally, such as all the ranges of poor castings, brasings, solderings, lack of understanding in its constructions and decoration and the good plater and bronzeur by his instinctive ability to judge a perfectly saleable article, must by his art hide and cover and perfect, the negligences of the artisan that preceded him in the work ninety out of a hundred times, the preceding ones get the credit whereas the real artisan has nothing but his own satisfaction. But if wrong in his judgment, then all the blame is put on his shoulders, from which neither mechanic nor scientist will relieve him.

It is a reasonable conclusion, that he who is able to produce these different finishes, should be considered first, where the highest art in metals, public memorials is considered, owned and viewed by all.

India, China and Japan stand foremost in the ancient art of metal colorization and their science is not in the coloring alone but the foundation laid in the beginning, mainly the mixture of the alloys used, thus "Shakus-do" consisting of copper 94-50, silver 1.55, gold 3.73, lead 0.11; with higher gold and silver contents and "Shibu-Ichi" copper 52 00/ to 67 00/, silver from 33 00/ to 48 00/ is used in castings, giving the bronzeur the benefit of higher grade metals to start with. To color these metals, one of the most widely known pickling solutions is used consisting of, one ounce of acetate copper, one-half ounce copper sulphate, one gallon of water heated, or one-half ounce acetate copper, one and one-quarter sulphate copper, on gallon of water, five drams of vinegar or acetic acid in proportion. They also have and make use of, covering the metal base with a lead covering using a Lye Bismuth and Lead solution then heating by dry heat until thoroughly fluxed, then polish. To find an unsightly or poorly finished article made in China or Japan is an exception.

Rare are the bronzes of the Ancients from the borders of the Tigris and the Euphrates, their metals were mostly used in warfare, but it is in ancient Egypt, Greece and Creta we find the perfection and the highest development of massive bronze, beautiful in their massiveness, their lines perfect in all their detail. And as the Athenians, in their love for beauty, perfected their achitecture, who dare say they would neglect their wingless Victory, or let the wiged Victory of Samutrace become a matter of scorn. Here again we find traces of the bronzeur. Rich and exceptionally rare are the treasures of Rome, endless seem the number of its memorials but none allowed to be neglected in the olden days of Caesar. To follow the Age of Bronze is to follow the age of the Bronzeur, and in this day would a museum consider itself justified to let any of its treasures go into decay? Hardly. Each one of the metal ornaments and subjects are treated and cared for with utmost care to eliminate the actions of chemical compounds absorbed in their respective component surroundings throughout the centuries of decomposition.

A bronze of Mesopotamia from the Euphrates and Tigris, black, green and blue and encrusted, the hardness and texture of Malachite still holds in its dried state the absorbed salts of any chemicals in active form, and some, of these salts, once subject to air moisture, develop into most violent corrosives.

A small figurine of Manin-Gil, Moon Goodess, was submitted to the author, the casting originally was solid but after three months, owing to climatic conditions developed a spot of corrosion and all methods of stoppage failed, as there was a constant loss in weight, I was asked my opinion, and stopped the corrosion after two months of constant daily treatment by lime carbonate.

The treasures of old Egypt from the tombs of the Kings must all be subjected to various processes to preserve them. On the Bronzes of Pompeii and Herculaneum, encrusted with ashes, decomposed by their alkaline compounds such as potassium, care must be taken not to increase the nature of the corrosive or the weakening of the structure compound. These and many other questions rise daily to hound the bronzeur, how to create new patinas or to preserve the old.

We give great credit today to Charlemagne the Great for the arts of revival of Bronzes and Brasses, who in the eighth century (797-802) with the help of Empress Irene, undertook

to restore the Bronze of Ancient Byzantine and whose methods and pickling solutions have descended to us and are used in modified formula until this day.

WHEN WILL OUR NATION TURN TO ART AGAIN?

European nations, Germany and France have within the past century made a very earnest effort to not alone create beautiful Bronzes but have appointed various commissions to create, preserve and enhance the Patinas on the monuments of their Great in spite of their poverty.

When will we entrust our bronzes to the Bronzeur and plater who knows and cares for Art, so that we may be enabled by our science of metal colorization, give credit to the art creators and their creations, as well as the metals they represent.

How then are these Bronzes treated properly? Owing to the ornamental structure, of highlights and depth, moisture distributes unevenly and the start of green, noticeable on the background first begins. Where ever any handrubbing is done, such as where man's hands come in contact, a direct deposit of sweat, composed largely of chlorides, will develop a patina of its own, and this chloride mixture, of photographic nature, tends to turn dark green and black from exposure to sun rays, wherever left to the elements entirely, and an unsightly coating is the result.

In coloring bronzes, whether structural or ornamental, the composition should be considered. There are as a rule, three grades of metal to be considered, "Copper" in its pure or near pure form, "Bronze" consisting of copper from 78 - 85$\frac{00}{}$, Tin 10 - 15$\frac{00}{}$, Zinc. min., "Brass" Copper from 68 - 85$\frac{00}{}$,Zinc 30 to 20$\frac{00}{}$. The richer the copper compound, the richer the patinate throw-off will be, in Zinc the blacker, in Tin the grayer. (B) On Bronzes exposed entirely to the elements, a natural green depending upon firstly the metallic structure, secondly, upon elementary conditions, namely moisture, heat and cold, creating expansion and contraction, then the elements, present in the surrounding air, such as Nitrates, Chlorides, Carbon Gas, Ammonium, and Sulphides and Sulphates. From these elements corrosion constantly raises from the base, a thickness of patina, which in time begins peeling as the thin coating of lime, contained in the dust particles is outside matter and is easily destroyed, and access of water directly upon the patina, such as rain, will start full action of the chemicals, absorbed in the

patinas, and is proved by the runs created upon the bases of stone and marble below. Therefore, when cleaning a bronze of this nature, it should, after the surface coating is relieved, taking care that the base metal is not attacked, a coating of solution is applied to check the action and harden it, and at the same time develop better coloring of even tones. (C) This has a tendency to neutralize and harden the whole surface, after this the whole bronze is waxed with wax solution mentioned before. However, bone oil may be substituted, but any varnish or drying oil is not permissible as it will in drying, contract too much and peel later on, and also would check the natural beauty. There are other means of treatment for statuary, indoors, where a dressing of Chinese wood oil in a wax solution will give a hard finish, however, a weak solution of white Japan and turpentine will answer. For structural bronzes, such as store fronts and elevator entrances, nitrate of copper in solution is used oftimes to give a base of yellow, brown or green, to build the right coloring on and in cases where a coating should be partly removed, a very weak pickle water (sulphuric acid and water) Baumé 2 - 4 can be more advantageously applied than cyanides, which would remove only after strong and severe applications.

I trust that these lines, given in the spirit of good-fellowship, to my confreres in the metal coloring may be of assistance in creating a new source of interest to all of us.

(A)

This compound has been tried by the author with following results:

Aqua, 1 gal., Acetate of Copper 3 oz., Acetic Acid ¼ oz., Sal-ammoniac ½ oz., Salt ½ oz., immerse for 15 - 30 minutes, let dry for a day, the second day immersion in lukewarm water one minute, let dry, then apply same solution by brush, and stipple. As this solution is varied in its compound, reducing contents, varied color from the lighter green to the darker is produced, then finally waxed with dissolved wax in turpentine.

(B)

The Patina stain put upon a statue or constructural bronze, after leaving the foundry is first pickled to remove the surface coating, and hand-tooled, then a stain is produced thereon by applying a bath, consisting of ammonium sulphide in water, 1 oz., of former to gallon of water, by sponge. The first coating

gives an idea of the condition of the bronze or metal, and may indicate a weakening of solution, or in case of brass or light bronze, a strengthening by applying a weak pickle solution over the stain then rinsing with abundance of water. The first coating is practically all removed by scouring with pumice, then the staining is repeated twice with intermediate rinse, then sand is used for relieving and scouring, which will relieve the highlights, and prepare it for the last and final staining. When dry the whole is waxed with a wax solution of turpentine and wax, ratio, 1 gal. turpentine, 8 - 10 oz. beeswax, 2 - 4 oz. carnauba (wax melted together and poured into turpentine. A slight addition of bronze powder to the wax is permissible for better and deeper tones and this bronze powder, easily decomposed by the wax and the elements, forms the first protective coating. Sulphide of Potassium or Sodium may be susbtituted, for that of Potassium, ½ oz. to the gal., of Sodium 1 oz, to gal., after that, nature takes its course, and it is on the preceding foundation that patinas form.

(C)

Water 1 gal., Acetate of Copper 2 oz., Sulphate of Copper 2 oz., Chloride of Ammonium 2 oz., Rock Salt 1 oz., Acidic Acid 1 - 2 oz., Chloride of Zinc 1 oz., Glycerine 1 oz. This solution is applied either by sponge or brush and the surplus absorbed, and left on bronze with this solution for at least 24 hours. After this a solution of lime water is applied.

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A Letter from Edward B. Sanigar

Mr. Wm. J. R. Kennedy,
Editor, MONTHLY REVIEW,
American Electroplaters' Society,

My dear Mr. Kennedy:

I am enclosing the abstracts for the October issue of the MONTHLY REVIEW. The abstracts will form the final Abstract Section as at present constituted, as I understand from Mr. Slattery that arrangements for the new abstract section will be completed for the November issue. I shall not, however, be severing entirely my connection with the MONTHLY REVIEW for I have undertaken to keep the Society informed, by means of abstracts, of the work of the Electrodepositors' Technical Society in England.

It was very gratifying to read Mr. Albert Hirsch's letter concerning the Abstract Section which you published in the current MONTHLY REVIEW. His idea of making a file of the abstracts is very good. Such a file will constitute a readily accessible record of recent developments in Electroplating and kindred subjects. Should anyone not wish to cut the abstracts from the MONTHLY REVIEW, they could make a file of the titles of the papers abstracted, together with the author's name, writing down also the issue and page of the MONTHLY REVIEW in which the abstract appeared, and file the cards according to subjects, for example, under the headings Copper plating, Chromium plating, Anodic Oxidation of Aluminum, etc. In this way the plater would have a handy bibliography of each subject without having to search through back numbers of the Review, and would be able to trace very readily any particular paper he may wish to consult. If kept up-to-date, the work entailed per issue of the MONTHLY REVIEW would be very little.

During the fourteen months I have been submitting the Abstract Section to the MONTHLY REVIEW, I have endeavored to present a summary, month by month, of the work done and progress made in Electrodeposition and allied fields. I hope the abstracts have been useful to the members of the A.E.S., have added to their knowledge and have stimulated them by showing them the interest taken in their work by research workers. If so, I am well repaid for the work I have done in collecting and editing the abstracts, and preparing them for publication.

With very best wishes,

Sincerely yours,
EDWARD B. SANIGAR

The Abstract Section

EDWARD B. SANIGAR

THESE abstracts are mostly adapted, by permission, from "Chemical Abstracts", the references to that publication being given in the form — *C. A.*, **27,** 3402 (1933) *i. e.*, Chemical Abstracts, Volume 27, column 3402 in the year 1933. The name appearing at the end of the abstract is that of the abstractor. Abbreviations for scientific journals are those used by "Chemical Abstracts" (see *C. A.*, **25,** 6019 (1931). E. B. S.

Silver-plating baths made by anodic solution of fine silver. K. W. FROEHLICH. *Mitt. Forschungsinst. Probieramt Edelmetalle* **8,** 15 (1934)— Instead of dissolving fine silver in nitric acid, precipitating it as silver chloride and then dissolving this in aqueous potassium cyanide solution, the author casts fine silver into anodes and suspends them in a potassium cyanide bath. Copper strips or silver strips surrounded by a clay cell serve as cathodes; by weighing the anodes before and after a certain amount of anodic solution, the silver content of the bath is determined and adjusted accordingly. This electrolytic method requires very little attention; as the current efficiency is about 70%, it is merely necessary to allow a calculated number of ampere hours to flow through the bath. Heating of the bath above 40° C. must be avoided, as otherwise the cyanide decomposes too easily. *C. A.* **28,** 4666 (1934).

Non-poisonous silver-plating bath. H. GOCKEL. *Z. Electrochem.* **40,** 302 (1934). — A thiourea bath is recommended as a substitute for cyanide baths. It is prepared by dissolving 25-30g. silver nitrate and 60-70g. thiourea in one litre of water and should be used at 30-35° C., 1.5 volt and current density of about 0.2 amp./sq. dm. (approx. 2 amps. / sq. ft. E.B.S.). A method for the preparation of thiourea is given. *C. A.* **28,** 4985 (1934).

The electrolytic deposition of tantalum from aqueous solutions. N. IZGARUISHEV and A. F. PREDE. *Z. Electrochem.* **40,** 295 (1934).—Tabulated results for solutions of glucose, potassium (salicylate) and resorcinol show the solution concentration, current density, efficiency, weight and character of the deposit, etc. No deposition occurred when the electrodes were separated by a diaphragm, and the current efficiency was low.

C. A. **28,** 4985 (1934).

Adherence of electrolytic deposits of copper. P. JACQUET. *Compt. rend.* **198,** 1909 (1934); cf. *Monthly Rev.* **21,** No. 1, 43 (August 1934). — The degree of adherence of copper to nickel is least on a sandpapered, greatest on a polished, surface and adherence increases as the strain in the deposited copper decreases (see abstract "Adhesion of electrodeposited nickel to brass," A. W. Hothersall, *Monthly Rev.* **20,** No. 4, 34 (December 1933). Unless the strength of adherence is less than a certain maximum (3000g. for the 5mm. strip), some copper will remain on the nickel when the copper plate is pulled off; this is especially so when the copper has been deposited from a slightly acid solution of copper sulfate. *C. A.* **28,** 4666 (1934).

Coating wire with copper, etc. U. S. patent No. 1,961,667. June 5, 1934. C. D. JOHNSON (to Johnson Steel & Wire Co.). — Wire, immediately after passing through a straightening machine, is passed, in straightened condition, through an upwardly directed fountain of plating material, such as copper sulfate solution. Apparatus is described. Cf. *C. A.* **27,** 2664 943 (1933).

C. A. **28,** 4696 (1934).

Apparatus for copper-coating iron or steel wire by use of copper sulfate solution. U. S. patent No. 1,961,148. June 5, 1934. J. L. HERMAN (To National City Bank of Cleveland). — Structural and operative details are described. *C. A.* **28,** 4696 (1934).

Cracking of nickel-plated sheet-brass objects, causes and remedies. H. REININGER. *Metallwaren-Ind. u. Galvano-Tech.* **32,** 143,163,211 (1934).— Cracking and splitting are due to inner strains set up by cold work, to residual polishing material, and to grain-boundary corrosion. Material to be drawn or pressed should be soft annealed brass in which the copper-rich solid solution predominates. *C. A.* **28,** 5015 (1934). CURTIS L. WILSON

Preece test (copper sulfate dip) for zinc coatings. E. C. Groesbeck and H. H. WALKUP. *Bur. Standards J. Research* **12,** 785 (1934) (Research paper No. 688). — The Preece test is used to detect areas of minimum thickness; it is applied by dipping the zinc coating in 1.27 molar copper sulfate solution for one minute periods until a bright, adherent copper deposit is obtained. The rate of solution of zinc coatings in copper sulfate solution is raised by increase in concentration of copper sulfate or of free acid. Stirring also increases the rate of solution and should be avoided in the test. Adhering copper may form on zinc coatings if wire specimens are rotated eccentrically, due probably to the formation of oxygen concentration cells. Electroplated and sprayed zinc coatings dissolve more rapidly than hot-dipped or galvannealed coatings, so that a greater number of immersions must be specified for the latter. The potential of zinc, or of a pure zinc coating, in copper sulfate solution decreases rapidly to a minimum, then increases slightly and finally gradually decreases. The minimum is affected by pH and temperature. There is no minimum for galvannealed coatings, or with the iron-rich layer of hot-dipped coatings. The minimum may be caused by delayed coagulation of basic zinc compounds. Cupric hydroxide changes the pH of 1.27 molar copper sulfate solution to 3.3 in 24 hours, and is recommended as a neutralising agent.

C. A. **28,** 5026 (1934).

Coating with tin. British patent No. 406,751. March 8, 1934. BENNO SIPPEL. — In the manufacture of spoons, knives, etc., the blanks are degreased by means of sawdust or the like, cleaned in an acid bath, washed in water, coarse-tinned by dipping in a tin bath containing fat, and then fine-tined in a bath without fat. The articles are subjected, after removal from the coarse-tinning bath, to violent vibration to remove excess tin and they may be coated with fat before dipping in the fine-tinning bath. After fine-tinning, they are brushed with fat and may then be cooled in running water and coated with nickel by electrodeposition. *C. A.* **28,** 5036 (1934).

The electrolytic deposition of chromium from aqueous chromic acid solutions. G. G. SCHMIDT and F. J. WEBER. *Oberflächentech.* **9,** 189 (1932).— The electrolytic deposition of metallic chromium from chromic acid depends on (1) the temperature, (2) the current density, (3) the concentration

of foreign acids and (4) the chemical nature and the cation of the foreign acid (e.g., H^+ or NH_4^+). A definite limiting value for the chromium deposition does not exist. The character of the deposit depends much on the foreign acid; it is either very hard so that it can hardly be polished, or it comes highly polished out of the bath. Addition of boric acid and ammonium sulfate hardens the coating which, however, has to be polished afterward if a bright appearance is desired. The effect of temperature on different additions is shown in tables. *C. A.* **26,** 5500 (1932). M. HARTENHEIM.

Electrolytic deposition of chromium from aqueous chromic acid solutions. F. J. WEBER. *Oberflächentech.* 11, 123 (1934). — Previous investigations into the current efficiency and effect of foreign acids in chromium-plating baths (cf. *C. A.* **26,** 5500 (1932) (See following abstract, E.B.S.) were continued and the influence of temperature, current density, concentration of chromic acid, nature and concentration of additions were taken into consideration. Brilliant deposits of chromium can be obtained at 20° C., with low current density if sulfuric acid is added. The current efficiency is small. At 40° C. the deposits are bright within wide limits of current density and amount of sulfuric acid. The effect of concentration of chromic acid is considerable; with 50 g./litre (approximately 7 oz./U.S. gallon E.B.S.) chromic acid the current efficiency is 16% at 40°C. even with 6% sulfuric acid at 20 amps./sq. dm. (186 amps./sq. ft. E.B.S.). With 200 g./litre (28 oz./gall.) chromic acid the efficiency is only 6% under the same conditions. A previously assumed limit for good deposits of 1.2% sulfuric acid with respect to chromic acid does not exist. Addition of phosphoric acid produces bright deposits within definite concentrations, but the efficiency is very low. Adding boric acid produces bright deposits within wide limits of 90-150% (with respect to the chromic acid) but the current efficiency is lower than for additions of sulfuric acid. Ammonium sulfate gives the same results as sulfuric acid. Chromium deposits produced at lower temperatures are harder than those produced at higher temperatures, and deposits made with ammonium sulfate harder than those with sulfuric acid. Boric acid hardens the deposits, the hardness increasing with increased addition. A mixture of sulfuric acid and boric acid produces greater hardness than sulfuric acid alone; boric acid also compensates the harmful effect of too much sulfuric acid and improves the action at too low a content of sulfuric acid. Phosphoric acid reduces the yield considerably even when present in small amounts; it should, therefore, be avoided absolutely. Test arrangements are described in detail and test results reproduced in tables. *C. A.* **28,** 4984 (1934).

The "Panzer" chromium-plating bath. R. BILFINGER and G. ELSSNER. *Metallwaren-Ind. u. Galvano-Tech.* **31,** 147 (1933). — A particular equipment is described. *C. A.* **28,** 4985 (1934). C. L. WILSON.

Black-finishing metal surfaces. British patent No. 406,033. February 19, 1934. The Roessler & Hasslacher Chemical Co. — Chromium surfaces are treated with a cyanide at high temperature sufficiently long to produce a hard and durable black finish. The process is applicable to chromium articles or to articles having a chromium surface plated on iron, steel, nickel, copper or alloy base. The articles may be immersed in a bath containing a fused cyanide, e.g., an alkaline earth cyanide or at least 30% of an alkali cyanide at 700-900° C. A chromium-plated copper bar may be treated 30 minutes at 825° C. in a bath

containing 30% sodium cyanide and 70% sodium carbonate and sodium chloride. The treatment of a mild steel bar is described, the bar being preferably case-hardened and then plated with chromium, immersed 20 minutes at 860° C. in a bath containing sodium cyanide 45, sodium carbonate 35 and sodium chloride 20%, and finally quenched in cold water.

C. A. **28,** 4693 (1934).

Chromium-plating articles such as those of ferrous metals. U. S. patent No. 1,963,391. June 19, 1934. R. J. WIRSHING and H. C. MOUGEY (to General Motors Research Corp.)—Articles are provided with a coating resistant to corrosion by acid solutions of calcium chloride by successive application of multiple sub-coatings such as nickel and copper which are deposited from acid baths, followed by deposition of chromium from a chromic acid bath and then heating for about an hour at a temperature of about 120° C. or for a shorter period at a higher temperature, but insufficiently to cause alloying of the chromium with the underlying metal. *C. A.* **28,** 4988 (1934).

Treatment of white metals for chromium plating. Belgian patent No. 399, 428. December 30, 1933. F. POMIANKOWSKI and F. VERLINDEN. — The molten copper-zinc-nickel alloy is treated with potassium salts which are volatilised and facilitate chromium plating. *C. A.* **28,** 4988 (1934).

Aluminum for reflectors. J. D. EDWARDS. *Trans. Illum. Eng. Soc.* (N. Y.) **29,** 351 (1934). — Aluminum surfaces are anodically treated (details not revealed) and the total reflectivity increased from 74 to 87% after treatment. A clear, glass-like coating is produced on the aluminum surface which is very resistant to abrasion. *C. A.* **28,** 4666 (1934). C. G. FINK.

Tests on "alzak" aluminum reflectors. A. F. DICKERSON. *Trans. Illum. Eng. Soc.* (N. Y.) **29,** 358 (1934); compare preceding abstract. — The outstanding advantage of the new finish on aluminum is its permanence.

C. A. **28, 4666** (1934). C. G. FINK.

The oxide coating of aluminum. W. CH. VAN GEEL and H. EMMENS. *Physics* **1,** 415 (1934). — Aluminum can be covered by a crystalline hydrated oxide layer if used as anode in a boric acid plus borate solution with current density about 0.5 amp./sq. dm. (approx. 5 amps./sq. ft. E.B.S.), current efficiency less than 100%, current decreasing for constant voltage. The oxide layer formed is amorphous (non-crystalline) if a 4% oxalic acid solution is used, current density 4 amps./sq. dm. (approx. 37 amps./sq. ft. E.B.S.) with cooling to room temperature, constant current, efficiency 100% (cf. Burgers, Claasen and Zernike, *C. A.* **26,** 3190 (1932)). Aluminum covered with the amorphous layer can be oxidised for a second time with formation of a crystalline layer under the amorphous one, with current efficiency for the second layer 100%. The amorphous layer behaves like a resistance in series with the crystalline layer. A primary crystalline layer can not be covered with an amorphous one, but loosens and falls off. *C. A.* **28,** 4986 (1934).

Coating light metals and their alloys. German patent No. 597,224. May 18, 1934. Vereinigte Aluminum-Werke A.-G. — In producing an oxide layer on aluminum and other light metals or their alloys by electrolytic oxidation, the process is effected in a number of baths, and the conditions are adjusted so that a soft flexible layer is produced in the first bath and a hard layer in the other bath or baths. Thus, a soft layer may be produced in an alkaline bath

and a hard layer in an acid bath, or a soft layer may be produced by a short treatment in an acid bath at a relatively high concentration and low voltage. Alternating current, and particularly polyphase current, is preferably used. Addition of glycerol or a fat or soap to the first bath is advantageous. When metal wire or strip is treated, the material may be conveyed continuously through the baths, and the subsequent mechanical treatments may be facilitated by applying talc or graphite to the coated metal or by adding talc to one of the baths. Specific processes are described. (Cf. *Monthly Rev.* **20,** No. 4,38 (December 1933). *C. A.* **28,** 4988 (1934).

Coloring aluminum surfaces. U. S. patent No. 1,962,339. June 12, 1934. W. J. COTTON (to National Aniline & Chemical Co.) — The material is subjected to superficial anodic oxidation in a solution containing chromic acid, and is then treated with a dye such as superchrome red B.

C. A. **28,** 4695 (1934).

Surface treatment and surface protection of aluminum and aluminum alloys. H. RÖHRIG. *Korrosion u. Metallschutz* **10,** 135 (1934). — The effects of surface segregations, the various mechanical and chemical cleaning and roughening methods, electrochemical oxidation treatments both with d.c. and with a.c., and the characteristics of the films obtained thereby, are discussed with respect to resistance against various corrosive media. The improvement of the films by treatment with boiling water or impregnation is shown by several diagrams. The cleaning of aluminum utensils is briefly discussed. *C. A.* **28,** 5022 (1934). L. PESSEL.

Prevention of corrosion of aluminum and its alloys. M. TAZAKI. *Tetsu to Hagane* **20,** 422 (1934). — Anodic oxidation in a mixture of potassium nitrate and sodium nitrate at 220-250° C. with alternating current potential of 100 volts and current density of 4 amps./sq. cm. for one hour for aluminum, and at 500-510°C. with alternating current potential of 65 volts and current density of 4 amps./sq. cm. (3,716 amps./sq. ft. E.B.S.) for 30 mins. for duralumin, gave good protection against corrosion in sea water. The tensile strength was scarcely changed. *C. A.* **28,** 5028 (1934).

Coating aluminum and its alloys. British patent No. 407,457. March 22, 1934. Aluminum Colors, Inc. — Coloring or corrosion-inhibiting substances are deposited in oxide coatings which have been produced electrolytically on aluminum (alloy) surfaces, and the coatings are then treated with water at above 80° C. as in U. S. patent No. 1,946,147 (*Monthly Rev.* **20,** No. 10,42 (June 1934)). *C. A.* **28,** 5036 (1934).

Protecting aluminum. French patent No. 43,237. April 6, 1934. Aluminum Colors, Inc. Addition to French patent No. 758,360 (see *Monthly Rev.* **20,** No. 11,44 (July 1934) E.B.S.). — The coating of oxide prepared as in French patent No. 758,363 is treated with a solution containing a chromate anion or a soluble silicate or other substance preventing corrosion or with an organic dye and then heated in water at above 80° C. *C. A.* **28,** 5036 (1934).

Treating aluminum and its alloys. German patent No. 595,592. April 18, 1934. W. GÖTZL. — Aluminum and its alloys are rendered non-corrosive by treating the coating (produced by electrolysis with a corrosive and peptising agent, such as sodium hydroxide, drying and heating) to produce a layer of aluminum oxide. *C. A.* **28,** 5036 (1934).

Effects of inhibitors on the solubility of iron and steel in acid. K. TERANO and T. TAKASAKI. *J. Soc. Chem. Ind., Japan* **37,** Suppl. binding 175 (1934). — Corrosion tests were carried out by immersing a polished steel plate in 3 *N.* sulfuric acid, for three hours at 30° C. and one half hour at 50° C. More than 400 inorganic and organic compounds, sulfonated fatty oils, colloidal substances, etc., were tested for inhibitive properties. Some thiocarbamates, dithio-carbamates and compounds with a thiazole group show a markedly restrictive action on the solubility of ferrous metal in acid. By addition of small amounts a clear bright surface is obtained after removal of the scale. The inhibitor action is possibly due to the formation of a film of the inhibitor material on the metal surface, and mechanical cleansing must be employed if electrochemical deposition is to be made. The evolution of hydrogen is diminished and embrittlement by pickling is greatly decreased.

C. A. **28,** 5017 (1934). K. KAMMERMEYER.

Cleaning metal surfaces before finishing. C. F. SCRIBNER. *Ind. Finishing* 10, No. 8,12 (1934). — The correct cleaning materials and methods to be chosen with respect to the characteristics and condition of the articles to be cleaned are described. *C. A.* **28,** 5026 (1934). D. THUESEN.

Cleansing compositions. German patent No. 597,210. May 18, 1934. Chem. Fab. Budenheim A.-G. — An alkali phosphate of alkaline reaction, preferably trisodium phosphate, is mixed with a subordinate amount of a phosphate of tin, or of a compound of tin which reacts with alkali phosphate in aqueous solution to yield a phosphate of tin. A part of the phosphate or other compound of tin may be replaced by aluminum phosphate or other compound of aluminum. The compositions do not corrode aluminum and tin and their alloys. Specific compositions are described. *C. A.* **28,** 5193 (1934).

Treating metals and alloys such as chromium-steel sheets, etc., to improve their resistance to corrosion. U. S. patent No. 1,961,752. June 5, 1934. C. G. FINK and F. J. Kenney. — Material such as annealed chromium-steel sheets in which differences in potential exist between different parts of the surface are rendered more resistant to corrosion by electrochemically dissolving the high-potential portions of the metal or alloy from the surface (the article being connected, in a bath such as chromic acid, as an anode) so as to establish a substantially equalised potential over the surface.

C. A. **28,** 4669 (1934).

Metal coatings as corrosion protectives on iron. S. BRENNERT. *Tek. Tid. Uppl. C, Bergsvetenskap* **64,** 33 (1934). — The extent to which metal coatings, produced by dipping or electroplating, may attack the basis metal through their electrochemical properties, if the coating is damaged, is studied. To determine this, it is recommended to couple a small surface of the basis metal to a large surface of the coating and measure the current in the circuit when immersed in the corrosive solution. The method is very sensitive and gives a good illustration of possible corrosive conditions. *C. A.* **28,** 5026 (1934).

Protecting iron against rust. German patent No. 597,365. May 23, 1934. Metallges. A.-G. (H. Weidmann, G. Roesner and W. Overath, inventors). — Iron is given a phosphate coating in known manner and then immersed in a bath containing a hydrolysable salt of aluminum, e. g., aluminum sulfate or aluminum acetate. A small proportion of a base may be added to the bath. Specific processes are described. *C. A.* **28,** 5036 (1934).

Electrodeposition of metals. British patent No. 406,767. March 8, 1934. GRACE E. ADEY. — In an electroplating process in which an anode of the metal to be deposited, provided with a sheath or pad of absorbant material saturated with electrolyte, is passed over the surface to be plated, the anode is connected to a source of interrupted direct current. Apparatus is described.

C. A. **28,** 4988 (1934).

The influence of mercury on the absorption of electrolytic hydrogen by iron. H. PLOUM. *Z. Electrochem.* **40,** 267 (1934). — Alekseev and Poukarov (*C. A.* **20,** 2779 (1926)) have shown that mercury and arsenic as impurities in an electrolyte cause a steel cathode to become brittle, and Koerber and Ploum (*C. A.* **27,** 254 (1933)) have shown that under these conditions hydrogen enters the iron. Ploum used steel cathodes in 1 normal sulfuric acid and found hydrogen evolution to be low but greatly stimulated by adding mercuric mercury irons, and then decreasing to a minimum again. This may mean formation of volatile mercury hydride (cf. Bonhoeffer, *C. A.* **19,** 2915 (1925)) with removal of mercury and restoration of previous equilibrium. With 0.1 normal alkaline solutions of lithium, sodium, potassium, ammonium and barium salts as electrolytes results indicated that formation of water-decomposable hydrides does not favor absorption of hydrogen by the steel cathode as none takes place unless mercury is added. Electrolytes containing magnesium, calcium, zinc, aluminum and chromium behave similarly. Independently of mercury hydride formation the mercury seems able to catalyse the entry of hydrogen into the steel cathode in either acid or alkaline solution.

C. A. **28, 4666** (1934). O. E. SHEPPARD.

Hydrogen brittleness of steel as a function of the absorbed amount of hydrogen. P. BARDENHEUER and H. PLOUM. *Mitt. Kaiser-Wilhelm-Inst. Eisenforschung, Düsseldorf* **16,** No. 11,129 (1934). — Hydrogen can be absorbed by steel in pickling processes or by cathodic electrolysis and has a harmful influence on the mechanical properties; in particular does steel or iron become brittle after pickling. The change brought about by hydrogen absorption disappears gradually in storage or under rapid heating, but the original state is not again obtained. Gold-working has a favorable effect on the removal of hydrogen. Absorption of hydrogen at room temperature decreases with increasing degree of cold-working. *C. A.* **28,** 5018 (1934.) M. HARTENHEIM

Electrodeposition of metals. British patent No. 405,433. February 8, 1934. Q. MARINO and The Darlington Wire Mills Ltd. — Zinc, copper, aluminum, tin, cadmium, lead, antimony, nickel, chromium or cobalt or an alloy of these metals is deposited from an electrolyte prepared by dissolving the tartrate, paratartrate or oxalate of the metals (s) in aqueous ammonia.

C. A. **28,** 4668 (1934).

Electrodeposition of metals. British patent No. 404,972. January 26, 1934. S. O. Cowper-Coles and Ferbrite Ltd. — Detached metal plates or sheets are mechanically conveyed through an electrodeposition bath at such a speed that the interval between immersion and emergence of any point of the plate does not exceed one minute and is preferably less than one half minute; a current density of at least 200 amps./sq. ft. is used. The deposit may be consolidated by rolling, e.g., for zinc at 80-100°C. Before plating, the plates are pickled by a cathodic treatment in hydrochloric acid or sulfuric acid. The rollers may be provided with heating means. *C. A.* **28,** 4669 (1934).

Printing surfaces. British patent No. 405,709. February 15, 1934. Bekk & Kaulen chemische Fabrik G. m.b.H.—Planographic or offset printing surfaces are prepared by applying the printing image to a finely grained base and subsequently rendering the grain of the non-printing parts coarser by electrolytic treatment; the grain can be similarly renewed when worn as a result of prolonged use. The image is applied to a base which is not attacked during the repeated production of the grain surface nor when etching to render the surface ink-rejecting. The plate is suspended as the cathode in an electrolyte, and the voltage and current density are selected so that the metal is deposited on the raised parts of the plate. The image is protected with a material which remains on the plate during printing, e.g., a varnish insoluble in the ink and particularly a varnish containing shellac or phenol-aldehyde resin which is rendered harder by heating, or a color-containing resin. Alternatively the image may be applied to a plate formed of a metal, e.g., copper, brass, iron, which is not attacked by the etching agents, the image being also coated with varnish if desired, and the non-printing parts being coated electrolytically with a water-retaining metal, e.g., zinc or aluminum. The electrolyte contains a solution of a base of the pyridine series or their compounds, e.g., an aqueous solution of zinc chloride and pyridine containing sufficient hydrochloric acid to give a pH of 3.0 - 5.5. *C. A.* **28,** 4670 (1934).

Electrodeposited laminated metallic foil containing copper, lead and tin. U. S. patent No. 1,963,604. June 19, 1934. R. A. WILKINS (to Industrial Development Corp.). — Minutely perforated electrodeposited laminated foil suitable for electrical condensers, etc., comprises a copper layer 0.002 - 0.001 inch in thickness, with a layer of tin covered by a layer of lead which in turn is covered by another layer of tin (the perforations being about 0.00005 inches in diameter and being produced by a process various details of which are described). *C. A.* **28,** 4988 (1934).

Metal plating, etc. German patent No. 595,659. April 19, 1934. J. BILLITER. — Apparatus is described for the electrolytic precipitation of metals in the form of tubes or tubular layers on a cathode. *C. A.* **28,** 4988 (1934).

Apparatus for electroplating. U. S. patent No. 1,963,363. June 19, 1934. P. P. HALE (to Metals Protection Corp.). Various structural details are described. *C. A.* **28,** 4988 (1934).

Apparatus for electroplating the interior of hollow cylinders. U.S. patent No. 1,964,736. July 3,1934. H. LE LAURIN and A.L.FRY. Various structural and operative details are described. *C. A.* **28,** 4988 (1934).

Color macroscopy by means of pH indicators. M. PROT and N. GOLDOWSKI. *Rev. mét.* **31,** 214 (1934).—The distribution of the electrolytic couples in corrosion specimens can be easily revealed by the colors of pH indicators added to a 10% gelatin solution of the electrolyte. It is applied with a brush or by spraying and develops the color in a few hours. The composition of the universal pH indicator recommended is given. *C. A.* **28,** 5014 (1934). J. D. GAT.

Plating metals. British patent No. 407,670. March 12, 1934. W. SAILER (to the Mead Research Engineering Co.). — A bath for plating metals by immersion only is obtained by dissolving a suitable metal salt in lignin-containing liquor which is substantially free from cellulose and has been subjected to oxidation, e.g., by hydrogen peroxide, or electrolytically.

C. A. **28,** 5033 (1934).

Protecting or decorating metal surfaces. French patent No. 43,151. March 9, 1934. É. Apart. Addition to French patent No. 757,147 (see *Monthly Rev.* **20,** No. 10,42 (June 1934)). — The depositing solution contains stannous chloride 2-20, zinc fluoride 0.5-4 and hydrofluoric acid 1-3 gram per litre. The stannous chloride may be replaced by a halide of antimony or cadmium and the zinc fluoride by a halide of iron, cadmium or nickel. Surfaces other than aluminum may be treated. *C. A.* **28,** 5036 (1934).

Behaviour of sprayed metallic coatings towards liquid and gaseous substances. H. REININGER. *Metallwaren-Ind. u. Galvano-Tech.* **32,** 235 (1934). — Containers in which liquids are to be boiled should not be coated with sprayed metal, as the vapor penetrates the microscopic pores and causes a mechanical failure. (See two abstracts of papers on sprayed metallic coatings and their properties by the same author, *Monthly Rev.* **20,** No. 3, 35 (November 1933). E.B.S.) *C. A.* **28,** 5026 (1934).

ABSTRACTS FROM THE EDUCATIONAL COMMITTEE

T. F. SLATTERY, Chairman.

Anodes for Chrome Plating in Solutions Containing Hydrofluoric Acid By Erich Müller and J. Vestdal

"Zeitschrift für Elektrochemie und angewandte physikalische Chemie"
Vol. 40 No. 1 - January 1934.

Anodes for chrome plating vary in their ability to oxidize tri-valent chromium to chromic acid. The anode composition and the acid radicals present are the factors which control this variation. With a lead anode and when the fluoride ion is present in solution, oxidation takes place according to the following equation when the current remains unbroken:—

$$3\ PbO_2 + 2\ Cr^{\cdots} + 2\ H_2O = 3\ Pb^{\cdot\cdot} + 2\ H_2CrO_4$$

As soon as the current is broken, however, the lead reacts with the fluoride to form lead fluoride which coats over the anode.

Anodes of pure Pb, 90 Pb - 10 Sb, 80 Pb - 20 Sb, 70 Pb - 30 Sb, 90 Pb - 10 Bi, 80 Pb - 20 Bi, 70 Pb - 30 Bi. were used in a bath containing 350 g/l chromic acid, .9 g/l sulphuric acid, .6 g/l HF. The current was periodically on and off and the anode potentials measured over time intervals. The current density was kept constant. The resistance layer was greatest on pure lead and less on the alloys. Pure lead and all the alloys were capable of oxidizing tri-valent chrome. Oxidation was more nearly complete at 40°C. than at 20°C.

The lead-antimony alloys were the least attacked especially at 40°C.

For chromium plating in the presence of fluoride ions, both with or without sulphate, the authors conclude that lead anodes containing between 20% to 30% antimony are the most suitable.

In case of the use of pure lead anodes, a short continuous electrolysis will remove the resistance layer of lead fluoride. WALTER R. MEYER

The Swelling of Graphite at the Anode and the Mechanical Destruction of Carbon Anodes By Heinrich Thiele

"Zeitschrift für Elektrochemie und angewandte physikalische Chemie"

Vol. 40 - No. 1 - January 1934

The mechanical destruction of carbon anodes is due in the main to the swelling of graphitic carbon.

The conditions under which swelling takes place are: deposition of oxygen at a potential of 1.6 volts and the presence of sulphate, perchlorate, nitrate or fluoride ions, then sufficient current density.

Swollen graphite contains more oxygen than the simple primary oxide of carbon. Together with the oxygen, sulphuric acid, perchloric acid, nitric and hydrofluoric acids are absorbed.

Graphite swells easily but is difficultly oxidized. Amorphous carbon swells difficultly and is easily oxidized. WALTER R. MEYER

The Influence of Cathodic Hydrogen on the Strength of Steel

by D. Alexejew, P. Afanassjew and W. Ostroumow

"Zeitschrift für Elektrochemie und angewandte Physikalische Chemie"

Vol. 40 - Number 2

Wire .35 mm thick and with .39% carbon content was subjected to cathodic Hydrogen in sulphuric acid of various concentrations and with additions of various catalysts. Very small amounts of sulphur dioxide or hydrogen sulphide (4 mg per liter) produced rapid embrittlement of the iron. The concentration of sulphuric acid studied from 4% to 40% had no effect on the rate of embrittlement. Wire under tension broke more rapidly the greater the tension.

The striking feature of the embrittlement produced under all the conditions was the harmful effects of very small quantities of current.

In pure sulphuric acid solutions, no embrittling effect could be observed but when a trace of arsenic, mercury or sulphur compounds were added very pronounced embrittlement occurred on electrolysis.

The hydrogen saturated wire showed no changes under metallographic examination, nor any change in lattice structure could be observed after X-ray study.

It is believed that the hydrogen is present in two forms in the wire: one a loosely bound form in the intercrystalline crevices which may be forced out by bending and moderate heat and a second form which is in solid solution with the iron.

The induction of brittleness is by the catalysts which form hydrides which act as transporters of hydrogen.

In the opinion of the abstractor, the above findings may have a bearing on the embrittleness often encountered in plating processes where arsenic, mercury or sulphur compounds may have been present. Small currents and little impurity will cause pronounced trouble. W. R. MEYER

Theory of Deposition of Chromium

by E. Liebreich

"Zeitschrift für Elektrochemie und angewandte Physikalische Chemie"

Vol. 40 - Number 2

Any theory of chromium deposition must not only deal with the deposition but also with the causes of the influences of the addition agents. All investi-

gators agree that at the cathode in both pure chromic acid and with acid addition agents, a film forms which enables the potential to be reached at which metal may be deposited. Erich Müller has determined the potential at which this film forms to be 1.3 volts referred to the hydrogen electrode. At this potential begins the reduction of hexavalent chrome to trivalent chrome.

Sargent and Liebreich independently arrived at the conclusion that deposition of chromium occurs from the di-valent state whose origin is made possible by the film formation. Erich Müller, however, believes the deposition occurs directly through the discharge of the hexavalent chromium. This deposition occurs when hexavalent chromium comes into immediate contact with the cathode through a perforation of the film by the anions of the acid addition agent. This film is regarded as being oriented so as to explain why it fails to dissolve in the chromic acid.

Liebreich's conclusions are:—

Perchloric acid and phosphoric acid are able, at very high concentrations, to cause reduction of chromium. Boric acid is not.

The fact that reduction occurs is not decisive over whether a servicable chrome deposit will form. The question of the solubility of the oxides, the structural quality of the salts formed as well as the solubility of the metallic chromium in the acid addition agents determine the quality of the plate.

The same position of the curve-branches of the voltage curves is evidence against the view that the acid addition agents exert a perforating action on the cathode film.

W. R. MEYER

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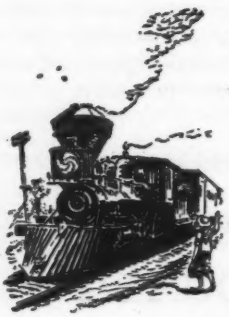

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DETROIT BRANCH

The regular meeting of the Detroit Branch, was held on Friday evening, September 7, 1934, at the Hotel Statler.

Mr. J. H. Hansjosten presided. There was a very good attendance.

Minutes of the previous meeting were read and approved.

Application of Mr. Davies reported favorable by Board of Managers, and he was unanimously elected to Associate Membership.

Committee Reports

A. B. Wilson read the report of the Finance Committee of the Convention. Also making it a report of the Secretary-Treasurer and Board of Managers, as follows:

Receipts

Registration	$2080.00
Advertisements	2745.00
Fellowship Club	225.00
Total Receipts	$5050.00

Disbursements

Office Expenses (Steno., Stationery, Postage, etc.)	$210.86
Printing	558.78
Badges	82.50
Transportation	296.20
Entertainment	2231.40
Research Fund	150.00
Supreme Society	100.00
Miscellaneous	83.32
Total Disbursements	$3713.06
Profit	$1336.94

The report was unanimously adopted, with great applause.

Correspondence. The Secretary read a letter from Resolutions Committee of the Convention as follows:

"Whereas, There will long linger in the memory of those in attendance the Twenty-Second Annual Convention of the American Electro-Platers' Society a recollection of a most successful meeting; therefore be it RESOLVED, That the thanks and appreciation of the Society be extended to the Detroit Branch, A.E.S. collectively, and to the members thereof individually, for their capable arrangements for the meeting and their unusual ability in providing for the members a combination of business, education, and unusual entertainment that has been a source of joy and inspiration to all who have benefited therefrom.

Respectfully yours,
F. J. Haulin, *Chairman*
Walter Train
Walter S. Barrows

It was duly moved, seconded and carried that the Detroit Branch write a letter of commendation to Mr. W. W. McCord for his wonderful work as Chairman of the Finance Committee for this Convention. Also to the Secretary-Treasurer for his valuable assistance to the Committees.

A motion was also made, seconded and carried that the Branch herewith discharge all Committees on Convention with thanks and appreciation of the work which they had accomplished.

The following Educational Committee was appointed:

Chas. H. Eldridge, Chairman; Elmer Woodmansee, Mr. Jamieson, Mr. Carter, Mr. Eastman, Mr. Spencer, Mr. Marshall, Mr. Kutzen, Mr. Withoff and Mr. Soderberg to act during this year.

New Business. Mr. Soderberg gave

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WATERBURY, CONN.

the Detroit Branch an invitation to meet with the Electro-Chemical Society some time in November, the date as yet not having been set. Mr. Soderberg was thanked for the invitation and was assured that Detroit Branch members would take advantage of the same.

A motion was made, seconded and carried that the Secretary write a letter to all suspended members, giving them credit for three months dues, providing they take advantage of this offer. In other words, it is meant that they come back to the Society and for three months there are no dues to pay, dues starting three months from date of their return to membership.

Also a motion was made, seconded and carried that for three months, October, November and December of this year, we charge no application fee for new members.

The next feature of the meeting was the paper by Mr. R. O. Hull, of the Grasselli Chemical Co., Cleveland, Ohio. Title of this paper was, "The determination of the thickness of the cadmium deposits, including a resume of the reasons for developments of the strip test, a description of it, and a real demonstration of its use." This paper was very interesting, educational and very much discussed. During the demonstration of this test, everyone in the room was very much interested in it. They all gathered around the table where the apparatus was being used. A copy of this paper will be published in the Review.

Meeting was adjourned at 10:15 P.M. T. C. EICHSTAEDT,

Secretary-Treasurer.

NEWARK BRANCH

The Newark Branch held its regular meeting at the Newark Elks Club. The attendance at this meeting was indeed good, 26 members. The attendance during the summer months has been fine and at no meeting had we less than 15 members.

Newark Branch has been very fortunate for the last three years in having splendid librarians and this year we have a wonderful fellow, a theoretical as well as practical man in Mr. Nelson Sievering.

The speaker of the evening, Mr. George Hogaboom spoke on the subject: "What is under the Plate?" When you see the plates on the screen you can no doubt be well satisfied in coming to the meeting and going home with a lot more to think about. Mr. Hogaboom was at his best and the members of Newark Branch thoroughly enjoyed his talk.

The following speakers have consented to address the members of Newark Branch and in securing men of such standing, Mr. Nelson Sievering makes a good start for a year of fine speakers:

September 21 — L. M. Graham.
Subject: Use of the Slide Rule.
October 5 — Dr. R. M. Burns.
Subject: Why, How and What Metals Corrode.
October 19 — C. Prator.
Subject: A Trip Around the World.
November 2 — Dr. H. Lukins.
Subject: Mechanism of Conductance.
November 16 — E. A. Anderson.
Subject: A Method of Multiple Nickel Plating on Zinc Base Die Castings.
December 7 — Dr. R. Mantell.
Subject: Aluminum Plating on other Metals.
December 21 — Movie night.
January 4 — Dr. A. K. Graham.
Subject: Plating from Zinc Cyanide Baths.
January 18 — Dr. C. H. Hepperstill.
February 1 — George Hogaboom.
Subject: Measuring Electro Plated Coating Thickness.
February 18 — Dr. Schoenfelt.

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This is only a start and in November, Newark Branch is going to have a real all-day session. Watch for the announcement of that meeting.

GEORGE REUTER, *Secy.*

BRIDGEPORT BRANCH

The Regular Monthly Meeting of the Bridgeport Branch was held on Friday, September 7, in the Chamber of Commerce Rooms of the Stratfield Hotel. There were twenty members present. Al Rosenthal, President had charge of the meeting. The Roll Call of Officers and the minutes of the last meeting were read and accepted.

Joe Sterling, Chairman of the Outing Committee reported that all arrangements had been completed with the Jockey Club of Devon for the Outing to be held there on September 8, rain or shine.

Ray O'Connor, Chairman of the Convention Committee, has appointed the following Committees for the 1935 Convention.

Tom Chamberlain, Secretary; George Hogaboom, Papers; George Karl, Hotel; George Knecht, Program; John Oberender, Visitations; Eugene Phillip, Advertising; the date will probably be around the 15th of June.

Mr. Raymond Meyer suggested that there be a definite educational session at each regular meeting in the future. As a start, Mr. Meyer will present a paper on the "Use of Electric Current in Plating and Pickling" at the next meeting. At each of the following meetings other members will have similar papers on relative subjects.

In an endeavor to raise the attendance at the meetings a prize is to be offered.

WILLIAM FLAHERTY, *Secretary-Treas.*

ST. LOUIS BRANCH

Regular Meeting of St. Louis Branch was held, Friday, September 15, 8 P.M. On account of the heavy rain the meeting was a little late, but we had a good meeting.

This was the first meeting since June and from now on we will have some interesting meetings and we urge all to attend so as not to miss anything that takes place.

St. Louis Branch started the drive for members. The Secretary will send out letters to men that are eligible and interested, asking them to join. By this we hope to bring some of the former members into the fold.

C. T. MCGINLEY, *Secretary*

MILWAUKEE BRANCH

The regular meeting of Milwaukee Branch was held at Lipp's Hall, N. 3rd. and W. Highland Ave., Thursday evening, September 13, 1934. Pres. Pat Sheehan called the meeting to order. A large membership was present. Mr. Roman C. Binder was accepted as an active member. Mr. Al. J. Hermansen spoke on bright nickel plating and brought out a lot of questions from the members present. Mr. Wm. A. Kuehl a member of Milwaukee Branch from Two Rivers, Wis., was present and took part in the discussions. Come often Bill! We need you at our meetings. We want to see and hear more of you.

FRANK J. MARX, *Secy.-Treas.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held Sept 8, at the Atlantic Hotel. President E. G. Stenberg presiding and all other officers present. Two new applications were received and the committees appointed.

Our Supreme President, Mr. H. A. Gilbertson spoke regarding the various committees that had been appointed and what was expected of them.

Mr. F. J. Hanlon suggested that the members start to think about whether they want a banquet or a smoker this year.

Mr. H. Faint explained a shop cost sheet problem to be worked out by the members and turned in at the next meeting and it should prove to be of great interest to all.

Mr. D. Greenblatt spoke of what he had seen at the Detroit Convention and brought out several good points that should start the members thinking about quality plating.

Mr. O. E. Servis the librarian found the following in the question box:

No. 1. *Has any one had any experience in using some of the advertised Nickel Brighteners and if so with what results?*

Ans. There are several Brighteners on the market that prove satisfactory.

No. 2. *What is used for a stop-off when a design is put on glass?*

Ans. Depends on whether the design is to be sand blasted or done with acid. Many suggestions were offered such as Ashfelt cut up with turpentine. The Defoe Paint Co. make an artist resist for china and glass that is very satisfactory.

No. 3. *What are the merits of nickel buffing composition with and without* 5% *petrolatum. That is* 5% *of total or about* 15% *of the grease content?*

Ans. A compound with 5% petrolatum is a better compound and cleans easier than a compound with no petrolatum, also when petrolatum is present in a lime compound it will keep from slacking longer.

No. 4. *How do you prepare a solution for salt spray test? How long should work remain in same?*

Ans. A 20% sodium chloride solution. Temperature 95°, as temperature is very important a piece at 60° that would stand 200 hours in a temperature of 200° would only last about 4 hours. Clean piece with Magnesium Oxide and wipe dry. Length of time will depend on your specification.

J. W. HANLON, *Sec.-Treas.*

WATERBURY BRANCH

Waterbury Branch held its monthly meeting, Friday, September 14 in Engineers Hall. Pres. Tennant Elwin presided. The various chairmen were instructed to get their committees functioning in order that the coming meetings may prove interesting and educational. Entertainment committee reported that arrangements were under way to secure the services of a speaker for our next meeting, which will take place Friday evening, October 12, Columbus Day.

Attention was called to the A.E.S. membership drive which is to be headed by Vice-President Joseph Underwood.

With the national convention taking place in Bridgeport next year, it should prove a big stimulus to the Connecticut Branches to enlarge their ranks.

Various subjects were brought up for discussion, one of them being, the benefits to be derived by the air conditioning of lacquer and enamel rooms. This subject is one that has been attracting quite a little attention of late, it naturally proved interesting.

W. F. GUILFOILE, *Secretary.*

ROCHESTER BRANCH

Rochester Branch held its regular monthly meeting at the Hotel Seneca on Friday evening August 17. President Kohlmeier opened the meeting and then turned it over to Mr. G. A. Lux, chairman of the Educational committee, who then introduced the guest speaker of the evening, Mr. F. F. Oplinger of the R&H Chemical Division of the E. I. duPont de Nemours Co., whom he introduced as an awfully good egg, an honest man and a real man who was very much interested in Electro-tinning and whose subject would be "Electro-tinning with a Sodium Stannate-Acetate bath."

In starting his talk Mr. Oplinger stated that Electro-tinning had been

of real interest for only 3 or 4 years but that previous to that there had been tin plating for many years back but from more or less complicated solutions which were very independable. The Sodium Stannate bath was the first to work out on a commercial basis and that this type bath had been in use by one of the country's largest electric refrigerator manufacturers for about five or six years. He pointed out the ease with which Electro-tinning can be done with the Sodium Stannate bath, giving you a temperature range from 140 to 170 degrees F., a Sodium Stannate concentration of from 12 to 30 oz. per gal. and a cathode current density range of from 10 to 25 amp/sq. ft.

He stated that a plate of only .0003 would resist a salt spray test of over 500 hrs.

He also said that Electro-tinning was cheaper than hot tinning and that this method enabled one to get a much heavier coating than otherwise.

He brought up many other points of interest such as the reclaiming of tin from scrap, the fact that milk corrodes most metals but does not affect tin, tin-plating over cadmium for sake of appearance because tin flash gives a silvery finish and that England controls the market on tin.

One other fact that he couldn't seem to emphasize enough was the absolute necessity of cleaning the metal to be plated, thoroughly, not just a plain cleaning operation such as for other plates but a real cleaning and an acid etch.

After his talk Mr. Oplinger was kept busy for quite a while answering questions. The Society then gave him a rising vote of thanks for a most instructive and interesting evening.

President Kohlmeier then took over the chair and the regular business meeting took place at which it was decided to hold our annual picnic on September 8th and the following committee was appointed: Mr. Prescott A. Lyons, Chairman, Mr. Frank Kolb, Mr. Jack Snyder, and Mr. Fred Glitzer. The meeting was then adjourned.

On Saturday, September 8th, the Rochester Branch held its annual picnic at "Summers Circle Spot" on the Ridge Road, just outside the city. Although it rained nearly all day, only letting up for about an hour in the afternoon, there was a very good turnout of the platers and their friends. A seven course chicken dinner was served at 5 o'clock and was voted perfect.

During a lull in the rain a 5-inning ball-game was played between Joe Ruff's "Cleaners" and Bill Hart's "Solvents", the Cleaners cleaning the Solvents by the score of 10 to 9. Batteries for the Cleaners — Elster and Wheeler — for the Solvents — Hart and McKechney. Umpire was Sylvester (Eagle eye) Gartland.

Races were ran off before and after the ball-game and the following winners went home with a satisfied grin on their faces.

Horse-shoe pitching—1st. Jerry Lux; 2nd, Joe Dutton.

Ball throwing—women—Mrs. Chas. Hehr; men, Mr. Berghold.

Spot race—1st., Mrs. Cliff Wheeler; 2nd, Mrs. Joe Ruff.

Marshmallow race—1st., Mrs. Bill Hart; 2nd., Mrs. Patswold.

Macaroni race—1st., Mr. Burns; 2nd., Mrs. Herlikoffer, 3rd., Mrs. Bill Hart.

Cracker race—1st., Mrs. Jack Elster; 2nd., Mrs. Joe Ruff; 3rd., Mrs. Earl McKechney.

There were several drawings for prizes; these being won by Freddie Glitzer, Mrs. Warren Guy, Joe Ruff and Mrs. Fred Breunig.

We also had a bean guessing contest and found one person who is a pretty durn good guesser. This was Mr. Geo. Scobell who guessed 1896 beans in the jar and there was 1897, so he was just 1 bean off. 2nd., was Mrs. Guerin and Mr. Prince, 2000 and 3rd., our esteemed umpire Sylvester Gartland, 2055.

At 8 o'clock we decided to call it a day and with everyone expressing their satisfaction over the outing we broke up.

The committee in charge of the day's activities were Mr. Prescott Lyon, chairman; Jack Snyder, Freddie Glitzer and assisted by our President Frank Kohlmeier.

On Friday night, Sept. 21, the Rochester branch held its regular monthly meeting at the Seneca Hotel. The meeting was presided over by president Kohlmeier. After the reading of the minutes the committee in charge of our picnic on Sept. 8th made its report and was then dismissed with a rising vote of thanks for a well conducted and enjoyable party. After a little more business the meeting was adjourned.

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Quite a few copies are returned each month marked "Unclaimed" or "Not at". The names on these copies are immediately taken out of our mailing list.

When you send a new address, please give the old address also. This is important.

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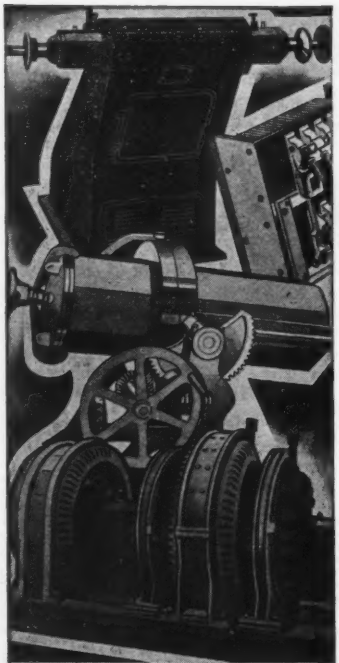

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